THE

Young Scientist.

1878 - 1883

A Practical Journal for Amateurs.

"KNOWLEDGE IS POWER."

see back cover for list of missing numbers

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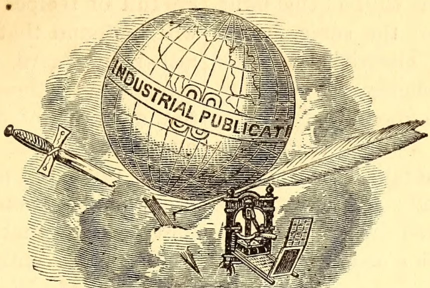
The Young Scientist

SCIENCE IS KNOWLEDGE.



KNOWLEDGE IS POWER.

A Popular Record of Scientific Experiments, Inventions and Progress

VOL. I. NEW YORK, JANUARY, 1878. No. 1.

Make-shift Apparatus—Its Successes and Failures.

THE majority of our text-books and books on popular science delight to tell us of the wonderful scientific discoveries which have been made by means of very cheap and simple apparatus. We are told how Newton investigated the laws of light and color by means of soap-bubbles—the emblematic plaything of children; how Black discovered latent heat by means of a few thermometers and old dish-pans; how illuminating gas and its applications were discovered by Murdoch, who used the bowl of a tobacco pipe for his retort, and the stem for the first main; how Franklin discovered the identity of lightning and electricity by means of a boy's kite, and dozens of other cases. All these instances afford example and encouragement to those who are trying, with limited means, to see for themselves the great wonders of nature, but they are sometimes liable to mislead those who are inclined to think that if Galileo, by means of a telescope which was little better than a modern spy-glass, made discoveries which have immortalized his name, it is not worth while for them either to procure costly apparatus or to spend great labor in finishing and perfecting that which they make themselves. To some persons the idea of "rough and ready" possesses wondrous charms, and they come at length to despise the neatness and care which are born of accuracy and delicacy, and without which no scientific work really worthy of the name can be accomplished.

In this connection two things must be borne in mind. In the first place, we must remember that if Newton made great discoveries with very insignificant apparatus, it required a Newton to do it; and in the second place, the extent to which such discoveries can be carried, even by Newton, are quite limited. When Newton pushed

his discoveries in regard to the colors of very thin films beyond the first steps, it taxed the utmost skill of the London opticians to supply him with lenses sufficiently accurate for his purpose. Franklin determined by means of a kite the fact that lightning and electricity are the same, but to investigate the laws of electricity requires apparatus of extreme delicacy and accuracy. Galileo discovered the moons of Jupiter with a telescope no better than that which any smart boy might construct for himself—lenses and all; to discover the moons of Mars demanded the aid of a telescope which it required a master hand to produce.

We hope our young friends will ponder these facts, and not be discouraged because they fail to accomplish, with inferior apparatus and tools, things which can be done only with the very best appliances. Neither should they be discouraged because they do not at first succeed in using their tools with the ease and skill which older hands have acquired. It is wonderful how far the skill which comes of long practice will carry one. And although good workmen generally have good tools, yet how often do we see an experienced hand accomplishing wonders with very inferior means? It is rare that a person of moderate experience can perform an experiment successfully at the first trial.

On the other hand, those who are compelled, by choice or necessity, to use make shift apparatus, should feel diffident in regard to the importance and truth of any discoveries that they may make until these discoveries have been confirmed by more careful investigation, undertaken with more perfect appliances. In this connection it will be well to bear in mind the saying of a noted scientist, who, after listening to the praises of a young man who was said to have made some very wonderful discoveries with very inferior apparatus, exclaimed: "Sir, it was not *in spite* of the badness of his apparatus that he made these supposed discoveries, but *in consequence* of it."

General Rules to be Observed in Using Cements.

SO much has been written concerning different cements, that our periodicals are full of recipes on this subject. But it will be found that the information given is rather in regard to the materials used in compounding these cements than in regard to the manner of using them, while it is unquestionably true that quite as much depends upon the manner in which a cement is applied, as upon the cement itself. The best cement that ever was compounded would prove entirely worthless if improperly applied. We have hundreds of recipes for glues, pastes and cements of different kinds, and yet the public is constantly on the *qui vive* for new ones, and no more acceptable recipe can be sent to our popular scientific and technical journals than one for a new cement. Now, the truth is, that we have cements which answer every reasonable demand, when they are properly prepared and properly used. Good common glue will unite two pieces of wood so firmly that the fibres will part from each other rather than from the cementing material; two pieces of glass can be so joined that they will part anywhere rather than on the line of union; glass can be united to metal, metal to metal, stone to stone, and all so strongly that the joint will certainly not be the weakest part of the resulting mass. What are the rules to be observed in effecting this?

The first point that demands attention is to bring the cement itself into intimate contact with the surface to be united. Thus when glue is employed the surface should be made so warm that the melted glue will not be chilled before it has time to effect a thorough adhesion. The same is more eminently true in regard to cements that are used in a fused state, such as mixtures of resin, shellac and similar materials. These matters will not adhere to any substance unless the latter has been heated to nearly or quite the fusing point of the cement used. This fact was quite familiar to those

who used sealing-wax in the old days of seals and twenty cent postage. When the seal was used rapidly, so as to become heated, the sealing-wax stuck to it with a firmness that was annoying, so much so that the impression was in general destroyed, from the simple fact that the sealing-wax would rather part in its own substance than at the point of adhesion to the stamp. Sealing wax or ordinary electrical cement is a very good agent for uniting metal to glass or stone, provided the masses to be united are made so hot as to fuse the cement, but if the cement be applied to them while they are cold it will not stick at all. This fact is well known to the itinerant venders of cement for uniting earthenware. By heating two pieces of delf so that they will fuse shellac, they are able to smear them with a little of this gum, and join them so that they will break at any other part rather than along the line of union. But although people constantly see the operation performed, and buy liberally of the cement, it will be found that in nine cases out of ten the cement proves worthless in the hands of the purchasers, simply because they do not know how to use it. They are afraid to heat a delicate glass or porcelain vessel to a sufficient degree, and they are apt to use too much of the material, and the result is a failure.

The great obstacles to the absolute contact of any two surfaces, are air and dirt. The former is universally present, the latter is due to accident or carelessness. All surfaces are covered with a thin adhering layer of air, which it is difficult to remove, and which, although it may at first sight seem improbable, bears to the outer surface of most bodies a relation different from that maintained by the air a few lines away, and until this layer or film of air has been removed it prevents the absolute contact of any other substance. The reality of the existence of this adhering layer of air is well known to all who are familiar with electrotype manipulation, and it is also seen in the case of highly polished metals, which may be immersed in water without becoming wet. Thus the surface of a needle retains this film of air so strongly that it will float on the surface of water rather than give it up. So, too, a drop of melted glue allowed to simply fall on a surface of dry, cold wood and solidify there, will often fail to adhere at all, while if the same drop had been rubbed in, it would have attached itself to it with wonderful power of adhesion. What is true of glue is true of almost every other cement, and unless this adhering layer of air is displaced, it will be impossible for any cement to adhere to the surface to which it is applied, simply because it can not come into contact with it.

The most efficient agents in displacing this air are heat and pressure. Metals warmed to a point a little above 200°, become instantly and completely wet when immersed in water. Hence for cements that are used in a fused condition, heat is the most efficient means of bringing them in contact with the surfaces to which they are to be applied. In the case of glue, the adhesion is best attained by moderate pressure and friction. When it is intended to unite two pieces of earthenware or glass together, or a piece of glass or other substance to metal, by means of a cement that is to be used in a fused state, the surfaces that are to be united should always be made so hot that the cement will become perfectly liquid while in contact with them.

To be continued.

College Workshops.

REFERRING to the fact that the liquefaction of oxygen, recently accomplished by MM. Pictet & Cailletet, has been within the reach of English scientific workers for years, *Nature* makes the following pungent remarks: "It is also clear that to cope with modern requirements our laboratories must no longer contain merely an antiquated air-pump, a Leyden jar, and a few bottles, as many of them do. The professor should be in charge of a work-shop, instead of an old curiosity shop, and the scale of his operations must be large if he is to march with the times."

THE

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☞ For Club Rates, etc., see PROSPECTUS.

Our Aims.

SCIENCE in its various applications is daily becoming more and more an element, not only of the education of our people, but of their everyday thought. But while it forms the most important element of the education of our modern schools, there are many persons outside of these institutions who have a taste for scientific culture, but who have neither the time nor the training required to enable them to attack ponderous text-books without a teacher, and yet who would like to acquaint themselves with the new developments of science, as well as with the new applications of old principles, provided these were presented in simple and concise form. Such persons have no time to study the larger periodicals, and from want of previous culture they often fail to understand them. As for the "Science Columns" of our political, literary and religious journals, the information they contain is too fragmentary to fill the requirements we have indicated.

In intimate connection with this well-recognized want, there is another, the supply of which we propose to make a prominent feature of our journal. It is characteristic of young Americans that they want to be DOING something. They are not content with merely *knowing* how things are done, or even with *seeing* them done; they want to do them themselves. In other words, they want to experiment. Hence the wonderful demand that has sprung up for small tool chests, turning lathes, scroll saws, wood carving tools, telegraphs, model steam engines, microscopes and all kinds of apparatus. In nine cases out of ten, however, the young workman finds it difficult to learn how to use his tools or apparatus after he has got them. It is true that we have a large number of very excellent text-books, but these are not just the thing. What is wanted is a living teacher. Where a living teacher cannot be found, the next best thing is a live journal, and this we propose to furnish. And in attempting this it is not our intention to confine ourselves to mere practical directions. In these days of knowledge and scientific culture, the "Why" becomes as necessary as the "How." We therefore propose to give clear and simple explanations of the principles involved in the various mechanical and chemical processes which we shall undertake to describe.

We have commenced this journal on a small scale for very obvious reasons. A journal of this kind is a novelty, and we do not wish any one to give up any of their present sources of reading for the sake of adopting this one. The low price of the YOUNG SCIENTIST, and the slight demand which it makes upon the leisure of its readers avoids this difficulty.

So much for the general character of the objects which we have in view. Our plans, in detail, will be found in our prospectus.

Aiding the Swindlers.

WHEN a swindling concern can get their wares puffed into notice by articles in the "Scientific" columns of our popular papers, they are almost certain to attain the end at which they aim. The following humbug has been exposed over and over again, but it is caught up every now and then by some of the hack writers of "Science Columns," and a new lease of life given to it. We clip from a recent issue of a popular monthly journal:

"Quite a notable industry is now carried on in Paris, namely, the manufacture of what are termed veneered diamonds, the method of production being briefly, according to the following fashion: The body of the 'gem' is of quartz, or crystal, this being considered the hardest and best

adapted substance that can be made available for the purpose. Then, after the crystals are cut in proper shape, they are put into a galvanic battery, which coats them over with a liquid, this latter being made of diamonds which are too small to be cut, and of the clippings and cuttings that are taken off of diamonds during the process of shaping them. In this way, all the small particles of diamonds that have heretofore been regarded as comparatively worthless, can now, by means of this ingenious French process, be made quite serviceable in the jeweller's art."

Every statement in this paragraph is false. Any such working over of small particles of diamonds is, in the present state of our knowledge, an impossibility. Stones which pretend to be thus veneered are, however, largely sold, and the swindle is assisted by journals which publish, without comment, paragraphs like that just quoted.

Liquefaction of Oxygen.

OUR scientific exchanges come to us with the announcement that M. Pictet has succeeded in liquefying oxygen. If this be true, it is unquestionably the most important scientific feat of the year 1877.

We must confess, however, that we have our doubts as to the truth of the statement, and for these reasons: In the first place all the accounts that we have seen are far from intelligible, but so far as they do convey clear ideas of the process, it would seem that oxygen, under a pressure of 4,800 pounds to the square inch, has been subjected to a temperature of 140° below zero (centigrade). The pressure of the oxygen was obtained by *generation;* that is, a given quantity of material capable of producing oxygen was placed in a retort capable of withstanding a pressure of 12,000 pounds per square inch, and when the gas was liberated, it produced the pressure stated (4,800 pounds per square inch) as there was no escape for it. The cold was produced by the evaporation of solid carbonic acid previously cooled by means of liquefied sulphurous acid. Now, all this has been done before, and to an enormously greater extent than is claimed by M. Pictet. Years ago Faraday produced a temperature of 110° C., by exposing a mixture of solid carbonic acid and ether to a vacuum. Natterer, by the use of bisulphide of carbon, instead of ether, in the above mixture, obtained a temperature of 140° C.

As to pressure; a pressure of 4,800 pounds per square inch has been but a trifle these many years, and might at any time have been obtained with a single acting pump of good construction operated by hand. By means of a *series* of pumps, Natterer obtained a pressure of nearly three thousand atmospheres! (See Cooke's "Chemical Physics," pages 299 and 600.) To nearly this temperature and pressure did he subject oxygen, and yet he failed to liquefy it.

The discrepancy here is so great that we feel there must be an error somewhere. Even if Natterer's estimates were too high, it is scarcely possible that he could have gone so far astray as to believe that he had nearly ten times the pressure that he had. On the other hand, it is unlikely that M. Pictet could have so greatly underestimated his temperatures and pressures; and it is still more unlikely that oxygen which has resisted 40,000 pounds per inch, and —140°, should yield to 4,800 pounds per inch and —140°. We are therefore afraid that M. Pictet has deceived himself, and that some impurity, or something similar, has been mistaken for the liquefied oxygen. We should, however, be glad to know that he has really accomplished this wonderful feat.

Since writing the above, further accounts, giving more minute details, have reached us, and although the evidence in favor of the fact is not to our minds conclusive, we must admit that since such men as Berthelot, Sainte-Claire Deville, Boussingault, Mascart and others, men of great experience in experimentation, have accepted the feat as accomplished, it is probable that the claims of MM. Cailletet & Pictet are well founded. But if so, the curious fact remains to be explained, that, with abundant means at their command, physicists have for years failed to accomplish the same thing.

Correspondence.

Information Wanted.

1. *Ed. Young Scientist*—Your prospectus having fallen into my hands, I see that you propose to bring your subscribers into communication with each other. I am very glad of this, for I find that when I write to make an inquiry of some papers, the editors just turn to some old receipt book and copy out of that, and ten to one the thing will not work, for, like the razors Peter Pindar tells us about, too many of the recipes that we find in "encyclopædias," and "dictionaries of recipes," were made to sell and not to be put in practice. A better plan is that which you have adopted, which is to open an exchange for the barter of ideas, for as some one says, "Everybody knows more than anybody."

So much by way of preface. Can any of your readers give me a really good method for "ebonizing" wood? I have several recipes, but none of them give good results. A recipe recently published in a prominent journal would not work at all. AMATEUR.

2. *Ed. Young Scientist*—Seeing by the circular announcing your journal, that you propose to insert letters from subscribers who desire information, I would ask if any of your readers can tell me how to repolish the brasswork of a telescope that has been in use for some time, and has become quite tarnished? I have used very fine polishing powders, but although this answers well for a few days, in a short time the instrument looks worse than ever.

RUSTYCUSS.

Laboratory & Workshop

[Specially written for the YOUNG SCIENTIST.]

The Art of Sharpening Edge Tools.

BY JOSHUA ROSE, M. E.

NO. I.

There is an adage which tells us that "a good workman never quarrels with his tools." And this is too often supposed to mean that we can make up for a defect in a tool by the employment of a little extra skill and care in its handling. A more correct interpretation, however, seems to be that a good workman so shapes and sharpens his tools that there is no need to quarrel with them, for in a tool made for any purpose there can be no fault that does not lie at the door of its maker or user, and we shall find that with tools, as with everything else, they are good servants in proportion as they are properly cared for and used.

The construction of every tool that the human hand can use is governed, both as to shape, strength, and the form of its cutting edge, by principles easily applied when properly understood, and to explain in a simple manner these principles and their application will be the object of these articles.

Beginning, then, with the common penknife, we have a tool which may be used either to cut, split or scrape; but since its duty is mainly that of cutting, its edge should be formed with a view to that end, thus fitting it to the largest class of work. This will, fortunately, not incapacitate it for the performance of its lesser fields of usefulness.

The shape of a penknife blade is in section that of a wedge, and the sharpness or keenness of its cutting edge depends upon the acuteness of the wedge, and upon how nearly we can make the two sides or facets at the thin end of the wedge meet, without either facet turning over towards the other at the extreme edge, and how smooth and even we can leave the facets at the edge. The difficulty experienced in accomplishing this is due to the weakness of the metal, which causes it to bend over and away from the surface applied to the instrument used for sharpening or abrading it. The acuteness of the wedge, in a new knife, is fixed by the manufacturer; hence we need not at present discuss it, but may pass at once to the sharpening processes.

If we grind a knife blade upon a grindstone, and then put it under a microscope, we shall find that it appears as shown in Fig. 1. The marks shown upon the facet are due to the fact that the cutting or abrasion performed by the grindstone or emery wheel, is done by the corners or angles of the grains of emery or stone, as the case may be, and it follows that the coarser those grains, and the harder the blade is pressed to the stone or wheel, the deeper, within certain limits, will these marks be. The blade is supposed, in Fig. 1, to have been held upon the stone with the plane of revolution of the latter at a right angle to the length of the blade, as denoted by the line A B, hence the fine teeth at the edge stand also at a right angle to the blade. If the length of the blade is held at an angle to the stone, the marks and the teeth upon the edge will stand at a corresponding angle, as shown in Fig. 2, in which the marks represent the plane of revolution of the grindstone. Suppose, then,

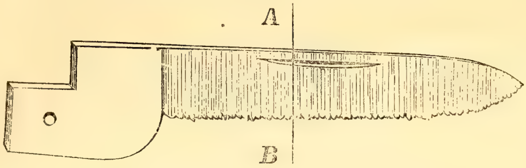


Fig. 1.

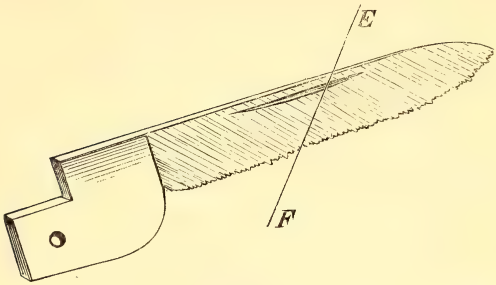


Fig. 2.

EDGE OF NEWLY-GROUND KNIFE, AS SEEN UNDER THE MICROSCOPE.

that we were to hold one side of the blade to the stone, in the position shown in Fig, 2, with the plane of revolution of the stone as denoted by the marks, and the other side with the plane of revolution in the direction denoted in the same figure by the line E F; then the marks on the facets and the indents at the edge will cross one another, leaving it less ragged than would be the case if both sides were ground as in Fig. 1, and since smoothness at the edge is desirable, we have arrived at the best position in which to hold the blade upon the stone.

If, after having ground the two faces, in either position, we put the blade under a microscope, we shall find that it appears as shown in Fig. 3, the edge being elongated beyond its natural length and turned to one side. The reason of this is that the metal, being weak, bends and gives way to the pressure, turning away from the face that is in contact with the stone, and it is obvious that the greater the pressure with which the blade is pressed to the stone, the more the metal will bend away.

Fig. 3.

It follows therefore that though the blade may be pressed firmly to the stone during the early part of the grinding, so as to remove the surplus metal as quickly as possible, it should be held lightly during the latter part, to avoid, as far as is practicable, the formation of this undesirable web, which is termed a *feather* edge, because of its weakness and ragged appearance. As soon as the knife edge is put to cutting duty, the feather edge breaks off, leaving a flat place at the thin end of the wedge, and to that extent impairing its sharpness. At what precise depth it will break off depends upon the pressure applied and the direction in which it is applied; but as a rule the harder the pressure, the deeper it will break off, and hence the more it will impair the edge. One of the best methods of removing it is to draw it lightly across a piece of soft wood, first lengthways and then across the grain.

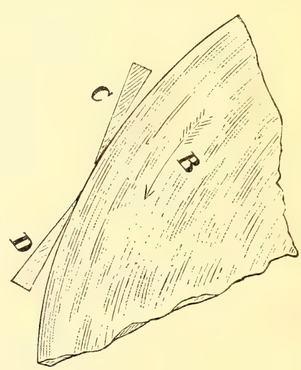


Fig. 4.

Another consideration now presents itself, for we find that the position in which the workman stands with regard to the stone has an important bearing upon the amount of feather edge that will be formed. Suppose, for instance, that Fig. 4 represents a section of a grindstone running in the direction of the arrow B, and that C and D represent sections of two knife blades; then C would have a long feather edge formed upon it, while D would not, and the latter is the best position; but if the stone has any very soft place in it, the blade held in that position is apt to catch, and if the stone is out of true, it is sure to do so more or less, and as it cannot then be held steadily, the face ground will be wavy, and a good edge becomes impossible.

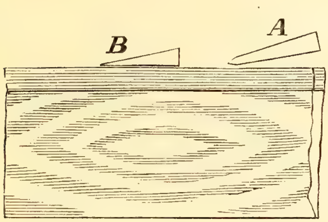


Fig. 6.

To obtain a finer cutting edge, we must have recourse to a finer abrasive, or, in other words, to an oilstone. The action of the oilstone is to smooth the surfaces, and thus remove the feather edge, but while doing this the oilstone itself turns the edge over, forming what is known as a wire edge, which is shown in Fig. 5 at A, which is formed from the causes already explained in referring to the formation of feather edges, and which resembles the feather edge, except that it is smooth, and to a greater extent continuous. In holding the blade to the oilstone, it is necessary to keep the face of the blade level, as at B, Fig. 6, or as nearly so as possible with the oilstone, while at the same time the pressure of the blade is greatest towards the cutting edge.

Fig. 5.

But if the blade has been frequently sharpened upon the oilstone since it was last ground upon a grinding stone, it may be slightly elevated, (as shown considerably exaggerated in Fig. 6 at A), which will give a durable and a moderately sharp edge; but at whatever angle the blade is first held to the face of the oilstone, it should be maintained there, otherwise the action will be to round off the edge. The motion necessary during the oilstoning is shown in Fig. 7, the blades lying diagonally across the stone. The motion of one side of the blade being from A to B, the position at A being shown in full lines, and at B in dotted lines; and of the other side from C to D, at C in full, and at D in dotted lines—the blade being frequently turned over, and the strokes being short and made under light pressure, so as to make the wire edge as small as possible.

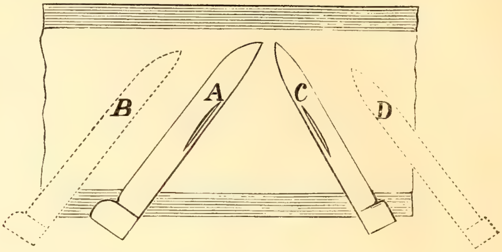


Fig. 7.

Penny Microscopes.

Many years ago a man in London made a living by selling "Penny Microscopes," which would exhibit the eels in paste, the scales on the butterfly's wing, and a few other common objects. Dickens, in his "Household Words," has given a most graphic description of the microscopes, the man and his family, every member of which performed some part toward the production of the little instrument.

These microscopes were made out of small boxes resembling pill boxes, in the lid of which was fixed the lens, while the bottom served to support the object, a hole having been made to allow the light to pass through, so that eels and similar objects might be viewed by holding the box up against the light. The distance between the lid and the bottom was very nearly equal to the focal length of the lens, and might be adjusted by slipping the lid on or off. The interior of the box was of course blackened.

The lens or magnifying power was, of course, a very simple affair. In this case it was nothing more than a drop of balsam of fir placed in a smoothly cut hole about an eighth of an inch in diameter. And yet such a microscope, if skilfully made, would do quite as good work as the brass affairs which are now so commonly sold in the

streets and stores of New York and elsewhere for a dollar.

Wishing to see how much could be done with such a microscope, we made one a few days ago, and tested it. We found that we could see distinctly a great many of the interesting objects about which we read in the books, and although we would not advise any of our readers to depend upon such a microscope for work or study, yet, as it would be a good exercise to make and test one, we will give the way in which we made ours.

We picked out a piece of thin window glass, quite flat and free from specks and air-bubbles. The sharp edges were removed by means of an old file, and the glass carefully washed with washing soda and water, no soap being used. We then took some Canada balsam, or balsam of fir as it is called, and boiled it hard on a second slip of glass. The heat must be moderate, and all bubbles and specks must be removed by means of a pin point. A single bubble in the lens will spoil it. A drop of this clear balsam, made liquid by heat, was placed on the first slip and made as nearly circular as possible. The slip was then laid flat and face downwards to cool and harden, being supported by a small box to keep the balsam free from dust and from contact with anything. The lens was now made. Its action was greatly improved, however, by placing a thin blackened card with a small hole between it and the eye.

A holder for such a lens may be made in a few minutes, with a pocket knife. Ours is shown in the engraving. The handle is simply a piece of wood,

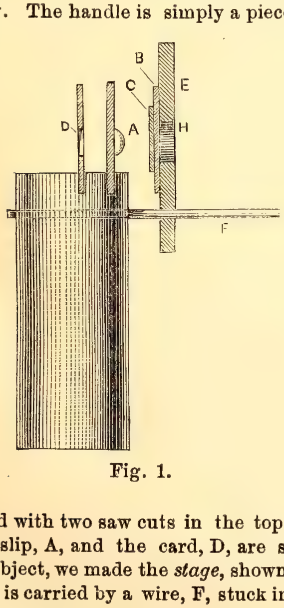


Fig. 1.

round, and with two saw cuts in the top, in which the glass slip, A, and the card, D, are stuck. To hold the object, we made the *stage*, shown in Fig. 2, and which is carried by a wire, F, stuck in the handle. The stage is a piece of wood, with a small hole, F, by which it slides on the wire, and another larger hole, H, to allow the light to pass through the object. Rubber bands, R R, serve to keep in place the glass slip, B, carrying the object. As similar letters refer to like parts in both figures, it will be easy to understand the disposition of the several parts.

After having made it, we went through our cabinet to see what we could do. Finding a piece of trichinous pork, we, with a sharp razor, shaved off a very thin slice (not thicker than tissue paper), which we moistened with glycerine and laid on the

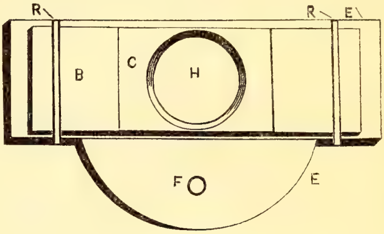


Fig. 2.

glass slip, covering it with a thin scale of mica, (used for stoves, and sometimes called isinglass). We had plenty of thin glass, but wished to use only such things as could be found in any country village. We saw the trichina, or pork worms, beautifully. There they lay coiled up in their *cysts*, or bags, and any one might, by the aid of such an extemporized microscope, have told whether this sample of pork was dangerous or not.

We then took a speck of sour paste, and after mixing it with a little water, placed it on the glass slip, strewed a few short pieces of hair (cut from our own head) amongst it, covered it with mica and examined it. The object of the hairs was to prevent the mica from crushing the eels, and when we have not the regular appliances they should always be used in the examination of animalcules. Seen by our penny microscope, the eels appeared very large and distinct, with their internal organs clearly seen through their transparent skins.

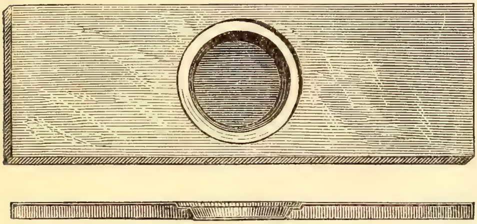
The most beautiful object, however, was the so-called globe animalcule (*volvox globator*). This object can be readily found in most localities in ponds of clear, still water. We have found it in New Jersey during every month in the year. It is too exquisitely beautiful to be described, and our readers should search for it until they find it.

The magnifying power of the microscope we used was about twenty diameters. Great confusion of ideas prevails in the popular mind in regard to magnifying power, and this confusion has been increased by street opticians, who claim "a thousand times" for microscopes which do not magnify as much as the one we have just described. This has produced a reaction the other way, and we have

heard of people who denounced as a fraud an inch lens because it was claimed to magnify ten times! In our next issue we will take up the subject of magnifying power, and the best way to measure it.

A New Slide for Microscopic Objects.

Mr. D. Bryce Scott, Curator of the New York Microscopical Society, has devised a very simple and ingenious slide, by which opaque microscopic objects may be mounted easily, quickly and well. The usual methods, as many of our readers know, is to make a cell on a glass slide—a tedious and comparatively difficult process, when a cell of some



METAL SLIDE FOR OPAQUE OBJECTS.

depth is required. The slide devised by Mr. Scott is of thin sheet metal (brass or tin), and is stamped so as to have a central depression, which forms the cell, and a turned down edge all round it which gives it strength, and causes it to lie steadily on any flat surface. The cell has a ledge, or rebate, as seen in the lower figure, for the purpose of supporting the thin glass cover. When made of tin the whole slide is japanned; those made of brass are lacquered, and the interior of the cell is covered with black asphalt, or some similar dark varnish. The objects are attached to the surface of the varnish by means of gum water, to which a very little glycerine has been added, and the thin glass cover may be cemented down and varnished on the turn-table in the usual manner. The simplicity and efficiency of this slide leads us to believe that it will become a general favorite.

Self-Lighting Lamps.

The well-known property possessed by some forms of platina, whereby it instantly ignites a stream of hydrogen, has long been utilized in the construction of self-lighting lamps. A few years ago these lamps came into great favor as a substitute for matches, from the fact that they were free from the fumes of sulphur, and there was no danger of rats or mice causing unexplained fires. The usual method of forming spongy platina into a mass to be used in igniting hydrogen, is to mix it with fine clay and mould it on a frame work of platinum wire. Platinum sponge prepared in this way is very friable, and must be kept packed in cotton wool when not in use. To get rid of this fragile character, Dr. Hare dipped asbestos, first in a solution of bichloride of platinum, and then in one of sal ammoniac, and found that the asbestos so prepared ignited hydrogen readily. But asbestos is not easily managed. We have succeeded admirably with pumice stone, which we first form into a cylinder of the proper size—say three-eighths of an inch in diameter—and then cut into discs about the twentieth of an inch thick, by means of a fine saw. These discs are soaked for some time in a strong solution of bichloride of platinum in alcohol, and afterwards for an equal period in a solution of sal ammoniac. After being ignited, these discs inflame a jet of hydrogen readily, and we find that they retain their power quite as well as the more delicate forms in common use.

Home-made Telephone.

Prof. Barrett, in a recent lecture on the telephone, gave a receipt for making a cheap one. Take a wooden tooth-powder box, and make a hole about the size of a half-crown in the lid and the bottom. Take a disc of tinned iron, such as can be had from a preserved meat tin, and place it on the outside of the bottom of the box, and fix the cover on the other side of it. Then take a small bar-magnet, place on one end a small cotton or silk reel, and round the reel wind some iron wire, leaving the ends loose. Fix one end of the magnet near, as near as possible without touching, to the disc, and then one part of the telephone is complete. A similar arrangement is needed for the other end. The two are connected by the wire, and with this Prof. Barrett says he has been able to converse at a distance of about 100 yards.—*Nature.*

Scientific Progress.

Lead in Paraffin Oil.—It has recently been found that paraffin oil, which is very similar to our petroleum, is capable of taking up a large percentage of lead.

Poisoned by Cheap Jewelry.—Two young girls in Paris were severely afflicted with sore eyes. Medical aid proved entirely ineffectual, until their cheap ear-rings, which doubtless consisted largely of copper, were removed.

Silk-Worms at Large.—Between San Jose and Santa Clara there are large quantities of silkworms at large. They are understood to be from the old stock of M. Provost. They multiplied on the poplar trees, and then attacked the fruit trees, so so that a fruit grower near by was forced to dose

them with kerosene to save his fruit. They finally gathered on the warm side of a brick building, spinning thousands of cocoons. It would seem from this that the Californians are likely to have an acclimated silk-worm, if nothing more.

Literature vs. Gymnastics.—A Michigan farmer puts it rather suggestively when he writes to the faculty at Yale College: "What are your terms for a year? And does it cost anything extra, if my son wants to learn to read and write as well as to row a boat?"

Nothing but Leaves.—We find in our English exchanges a number of inquiries in regard to the drying and coloring of leaves for ornamental purposes. If an interest should be awakened in this subject, the collecting and exporting of autumn leaves from this country will undoubtedly become a matter of importance. The gorgeous colors of our forest leaves are universally allowed to be unrivaled.

Long-Lived Errors.—The assertion that plants take up whole diatoms and assimilate them, an assertion which was made primarily for the purpose of aiding the sale for manure of the enormous Richmond deposits of fossil infusoria, was thoroughly refuted in the "American Journal of Microscopy," and the refutation was extensively copied into other papers. And yet one of our most popular scientific weeklies reiterates this stupid blunder in a recent issue!

Iron Bird Shot.—It has recently been suggested that iron shot would be better for sporting purposes than lead, and the originator of the idea has elaborated complicated machinery for making the article. His reasons for preferring iron to lead are that shot made of the former metal would keep its shape better, not being liable to get bruised and flattened, either in the pouch or the gun. He does not seem to know that small iron shot would be almost worthless as compared with lead, owing to its lightness. Substitute iron shot for leaden pellets, and you will reduce the range of your gun nearly one-half.

Non-Conductor for High Temperatures.—Mr. Fletcher, of Warrington, England, produces a very perfect non-conductor by mixing one part of ganister or refractory clay and six of sawdust, ramming them in a mould and firing. This makes, after burning, a firm cellular mass, in texture almost like pumice stone, and its power of retaining heat is such that, in this casing, which is only half an inch thick, half a pound of cast iron may be melted, and the furnace, crucible and all, may then be held in the hand without feeling the heat to any considerable extent. The applications of this material are numerous and important. As a jacket for ordinary furnace work, it will prove invaluable in all places except when exposed to mechanical wear. We would suggest that where it is liable to be abraded, a coating of some firmer material be applied. This latter will no doubt conduct heat better, but if protected in this respect by a layer of the new non-conducting material, the loss will be trifling.

The Paris Exhibition.—The buildings of the coming Paris Exhibition in 1878 are the largest yet conceived for the purpose. The nave of the main building is nearly 2,200 feet long; the vista, which includes the two vestibules, is more than 2,360 feet; and each of the transepts and vestibules, more than 1,100 feet. The eight industrial courts are all parallel, and are divided into two series of four each, one series being devoted to the productions of France, and the other to the rest of the exhibiting nations. In the centre of the garden between the two series are two ranges of fine art galleries. On the opposite side of the river is the Trocaden Palace, which is to be devoted to the history of man from the savage state down to the most modern appliances of science and art. It will afterward be used as a municipal museum.

Practical Hints.

Plaster of Paris.—A writer in the "English Mechanic," having occasion to prescribe plaster of Paris as an ingredient for a cement, calls attention to the fact that common plaster, as usually sold in the oil shops, will not do. The plaster used by Italians for making their images is the only kind that will answer. The reason probably is that the latter is sure to be fresh.

Black Finish for Brass.—A writer in the "English Mechanic" gives the following as a good black finish for brass. Make the articles bright, then dip in aqua fortis, which must be thoroughly rinsed off with clean water. Then make the following mixture: Hydrochloric acid, 6 lbs.; sulphate of iron, $\frac{1}{2}$ lb.; white arsenic, $\frac{1}{2}$ lb. Be careful to get all the ingredients pure. Let the articles lie in the mixture till black; take out and dry in hot sawdust, polish with black lead, and lacquer with green lacquer.

Parasites on Canaries.—Almost every one of these household pets is annoyed with little parasites, which render them weak by loss of blood and nervous irritation. To get rid of them we must study their habits. It is a curious fact that these parasites generally feed during the night, and leave the birds during the day. If the cages are provided with hollow perches, they will creep into them, and may be destroyed by boiling water. If the birds like to frequent a nest instead of a perch,

make the nest of something that may be dipped occasionally in boiling water. Half the diseases of cage birds are caused by these almost invisible parasites. Mounted in glycerine jelly, they form very interesting microscopic objects.

A Good Mucilage.—It is said that a mixture of one part of *dry* chloride of calcium, or two parts of the same salt in the *crystallized* form, and thirty-six parts of gum arabic, dissolved in water to a proper consistency, forms a mucilage which holds well, does not crack by drying, and yet does not attract sufficient moisture from the air to become wet in damp weather.

Brass Lacquering.—If you want a good deep gold lacquer, you should make up a small stock bottle, holding, say, half a pint, according to the following recipe; you can then add as much as may be required for the tint you wish to get: Alcohol, ½ pint; dragon's blood, 1 dram; seed lac, 1½ oz.; turmeric, ¼ oz. Shake up well for a week, at intervals of, say, a couple of hours; then allow to settle, and decant the clear lacquer; and if at all dirty, filter through a tuft of cotton wool. Mix with the pale lacquer a day or two before you wish to use it.

Ink that will not Freeze.—Mr. H. A. Sprague, having tried a mixture of alcohol with ink, found that the compound spread and was useless. He then tried glycerine mixed with ink, and found it too thick. Finally he tried a mixture of equal parts of concentrated glycerine, alcohol and water, deeply colored with aniline black. This mixture did not freeze in the coldest weather, it flowed freely from the pen, and did not spread. Our only fear would be that such ink would not dry thoroughly.

Magnifying Power.—Few persons have a clear notion of the magnifying powers that have been or can be obtained by means of the microscope. The following will be found trustworthy: A common hand magnifier, 1 inch focus, magnifies ten times; very strong glasses, twenty times; small globule lenses, such as were sold for 25 cents, about 50 to 75 times; the most powerful single lenses that can be generally used, 150 times; the most powerful single lenses ever found available, 300 times; ordinary compound microscopes, highest power from 250 to 500 times; highest power ordinarily obtained with the best microscopes, 1,500 times; highest power yet obtained, giving fair light and definition, 15,000 to 20,000 times. Claims have been made for much higher powers, but such claims are generally ignored by the best microscopists. By *times* we mean, in all cases, *diameters*. Sidewalk opticians generally mean *areas* when they speak of times. Areas are found by multiplying the diameters by themselves. Ten times, mentioned above, is 100 areas. The cheap microscopes said to magnify 1,000 times, magnify about 33 diameters.

BOOK NOTICES.

A Treatise on Engineering Construction: Embracing Discussions of the Principles Involved, and Descriptions of the Material Employed in Tunnelling, Bridging, Canal and Road Building, etc., etc. By J. E. Shields, C. E. 44 illustrations. New York: D. Van Nostrand.

It would, very evidently, be utterly impracticable to present, in 138 pages, anything like a full statement of the principles involved in the branches of engineering discussed in this book. Between the elements of the subject, however, which are known to every young engineer, and those higher departments of study which are practically valuable only to those professional engineers who make a specialty of certain departments of construction, there lies an important range of applied science, which is of the utmost value to others besides professional engineers. This is the field which Mr. Shields has attempted to occupy, and he has done his work well, giving in clear and concise form just that practical information required in the every day work of the engineer, the builder, the architect, etc. Viewed from this standpoint, the work must be regarded as one of great value to a very large class.

The Gas Consumer's Handy Book. By William Richards, C. E. London and New York: E. & F. N. Spon.

A great deal of the trouble which arises between gas companies and their customers is caused by the ignorance of the latter, and this little book will serve a useful purpose in helping to remove these difficulties, if it should do nothing else. But it will do more than this. It will enable every gas consumer to get the greatest possible amount of good from the gas which he consumes. It will effect this in two ways: first by teaching how to use the article effectively, and, secondly, how to avoid the evil effects which it is apt to produce when burned without proper attention to ventilation and the effect of strong light on the eyes. The work is simple and reliable, and should be in the hands of every householder that uses gas.

EXCHANGES.

In this column yearly subscribers who may wish to *exchange* tools, apparatus, books, or the products of their skill, can state what they have to offer and what they want, *without charge.* Buying and selling must, of course, be carried on in the advertising columns.

Wanted, a small turning lathe, about 1½ inch swing, and 12-inch bed; must be well made; books and apparatus in exchange. R. M., care of this journal.

Wanted, a copy of Holtzapfel's "Mechanical Manipulation." State what is wanted in exchange. E. W., Box 4875, New York.

Wanted, a good aquarium, medium size. State what is wanted in exchange. R. H., 8 Beekman Place, New York.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A Popular Record of Scientific Experiments, Inventions and Progress

VOL. I. NEW YORK, FEBRUARY, 1878. No. 2.

General Rules to be Observed in Using Cements.

Concluded from page 3.

ANOTHER very important point is that as little cement as possible should be used. When the united surfaces are separated by a large mass of cement, we have to depend upon the strength of the cement itself, and not upon its adhesion to the surfaces which it is used to join; and in general cements are comparatively brittle. At first sight one would suppose that the more cement there is used, the stronger will be the joint, and this is an error into which most inexperienced persons fall. Two pieces of earthenware, joined together by a layer of shellac as thin as possible, will adhere together and will be as strong at the junction as at any other part, while the same pieces united by means of a layer of the same cement an eighth of an inch thick, would fall apart on receiving the slightest jar. The rule which directs us to use as little cement as possible admits of no exceptions, and as a general thing the only way to obtain thin layers of cements that are to be used in a fused state, is to heat thoroughly the pieces that are to be united, and press them forcibly together.

The last point to which we shall call attention is the necessity for cleanliness, both in the preparation of the cements and in the application of them. It may be safely laid down as a positive rule that every extraneous substance that is mixed with the material of a cement is an injury to it. Glue prepared in a greasy pot cannot be expected to make a strong joint, and the presence of dust and dirt tends to weaken *all* cements. So, too, in the application of cements. If we attempt to glue together two surfaces of wood that are covered with dirt, the substances that are to be united are not wood to wood, but dirt to dirt, and the joint, instead of possessing the strength of wood

united by means of good glue, will have simply the strength of dirt. Moreover, we must remember that the different cements do not adhere with equal force to substances of different kinds. Thus glue adheres powerfully to wood and paper, but not at all to metal or glass. Shellac, if properly applied, adheres readily to earthenware, glass and metal, but not to some other substances. If, then, we apply glue to a greasy surface it will not stick. Hence the necessity for great cleanliness. All surfaces should be kept as clean as possible, or if they should get accidentally soiled, they should be carefully cleaned. The mere rubbing of two wooden surfaces with a dirty hand will weaken the subsequent glue joint by at least ten per cent. When glass or earthenware are accidentally broken, and it is not convenient to mend them on the instant, they should be carefully wrapped up in separate pieces of paper and laid away where they will not be soiled, and where the edges will not be chipped. In the case of broken glass or earthenware, the joint will be greatly disfigured and considerably weakened if the edges are chipped and broken by careless handling, or by being needlessly and frequently fitted together. Keep the pieces from contact with each other and with foreign substances, until you are ready to join them, and the joint will then be not only strong, but almost invisible.

It may be well to remind those who have had little experience in mending broken articles that it is quite important that the color of the cement should accord with the color of the article to be mended. A white porcelain cup mended with black cement would show some very ugly lines. If, however, a white cement be used, the lines of fracture will be invisible.

—Mr. S. H. Scudder, librarian of the American Academy of Arts and Sciences, has prepared a catalogue of all scientific publications, whether issued at stated or irregular intervals. The work will be published, and will extend to 300 pp., large octavo.

Beauty and Strength.

IT is a notable truth, that the most elegant forms are in general the strongest. The line of grace and beauty is not only correct as an element of art, but as a model for the architect and the engineer. The massive stone structures of olden times, in which huge flat stones took the place of arches, were singularly inelegant and very weak, when compared with the light and graceful arches of modern times. And it is not only in regard to the extensive works of the engineer and architect that this principle applies; in the designs of the carpenter, the machinist, the blacksmith, the tinsmith, and a host of others, it will be found that gracefully curved lines confer an element of strength as well as of beauty. Vibrations, when transmitted along such lines, are never suddenly checked, and the material is never exposed to those sudden strains which always occur wherever right angles and square joints are found.

Crossing the Atlantic in a Twenty-foot Boat.

EVERY ONE of our readers has probably heard of the feat of Captain Crapo and his wife, who recently crossed the Atlantic in a boat whose tonnage is a little over a ton and a half. The enterprise was a bold one, especially for a woman, and as no well-illustrated account has yet been published of the boat and her voyage, we feel sure that a large number of our subscribers, especially those interested in boat-building, yachting, canoeing, etc., will be interested in the following description.

No great problems have been solved, and perhaps nothing has been done, the possibility of accomplishing which with certainty could not have been predicted beforehand. Captain Crapo and his wife have, however, the merit of proving, by actual experience, that long voyages can be made, in very rough weather, in comparatively small boats; and to the captain is due the credit of showing just the means required for this end. Moreover, the fact that such

a small craft could live in the roughest sea, throws a good deal of light upon the possible migrations of prehistoric peoples, whose vessels were undoubtedly small and imperfect, but whose skill in managing them was unquestionably very great.

Fig. 1.—THE LITTLE BOAT THAT CROSSED THE ATLANTIC.

The voyage was undertaken by Captain Crapo, more in a spirit of daring adventure than of scientific research, but the same may be said of all the balloon voyages which are made, with, perhaps, one or two exceptions. The project occupied his attention for some time before he put it into actual practice, and having been on many whaling voyages, he was able to obtain clear ideas of the conditions required, and to work out the plans necessary for complying with them.

The "New Bedford," which is named after the city from which she sailed, resembles in model an ordinary whale-boat, but has rather more dead rise. She was built by Mitchel, of New Bedford, and is constructed of cedar on an oak frame, planked

both inside and outside, so as to ensure great strength.

The following are the principal dimensions: Length of keel, 13 feet; length over all, 19 feet 7 inches; beam, 6 feet; depth of hold, 2 feet 10 inches; draft (mean), 1 foot 1 inch; shear, 1 foot 4 inches; rise of deck beams, 4 inches; tonnage, C. M., 1.62.

The boat is schooner rigged; length of main-mast, 20 feet, 4 inches; length of fore-mast, 21 feet; length of boom, 10 feet; area of sails (fore and main), 25 square yards. She carried the American ensign and her own burgee.

The deck extends the whole length, with only two openings, each 24 by 18 inches, one forward (kept closed during the entire voyage), and the other aft, the latter being provided with a sliding cover. The centre-board was about 4 feet long.

Our engraving, Fig. 1, gives a very good idea of the general appearance of the vessel; Fig. 2 is a plan of the deck; Fig. 3 is a longitudinal section of the boat, and Fig. 4 is a cross section. The binnacle, with compass and lamp, are shown at *a*, Fig. 3; the water kegs, *c c c c c*, holding 20 gallons each, were disposed as shown in Figs. 2 and 4, and the sleeping berth of Mrs. Crapo at *b*, Fig. 2. This was so small that when she lay down her feet rested on the water kegs, and it was utterly impossible to turn round without first getting out. As for the captain, when he lay down, he was obliged to curl himself up, and the only times that he was enabled to fairly stretch his limbs was when he boarded passing vessels.

The equipment consisted of an anchor and cable, a drogue,* fifty fathoms of drogue line, a compass, binnacle and lamp, kerosene oil stove and utensils, five water kegs, etc. The stores consisted of 90 lbs. of biscuit, 75 lbs. of tinned meats, 100 gallons of water, together with a proportionate quantity of tea, coffee, sugar, and light articles generally.

The voyage took a much longer time than was expected, however, and the supply of provisions was found to be short. When four or five weeks out at sea, the water became unfit to use, and a fresh supply had to be obtained from passing vessels. A supply of water, provisions, and two bottles of brandy, were also kindly given by the captain of the steamship "Denmark," on July 8th. Some provisions and two bottles of wine were also obtained from the "Gustave d'Oscar," a Bremen bark, bound for New York.

During the voyage the sea broke over the deck only once. When a wave would approach, and there seemed to be every indication of its breaking over the boat, she would ride over it without even breaking the crest. An examination of the deck plan, Fig. 2, will show that the water kegs were stowed amidships, while the locker containing the stores was in the extreme stern; the living weight was also always very far aft, so that the centre of gravity of the whole was abaft the centre of length of the boat, thus presenting the long arm of the lever to advancing waves, besides bringing the centres of lateral resistance, load water line, gravity and buoyancy all at or near one plane; and this will account for the great seaworthiness of the boat.

When it was too stormy to sail, the drogue was thrown overboard, with fifty fathoms of line, and then the hatch cover was nearly closed, a small opening being left for ventilation. The vessel would ride to the drogue, while the captain and his mate would take a few hours' rest. Although the voyage was somewhat uneventful, the weather was rough and tempestuous, indeed, extraordinarily so for the time of the year. The captain thinks that if he had pursued a more northerly course, he would not have encountered such rough weather. No serious accident occurred, except the

*As some of our readers may not understand what a *drogue* is, and as the word is not found either in Webster or Worcester, we may say that it is a frame, usually of iron, to make it sink, covered with canvas, and so fastened to a line that, when drawn through the water, it must move flatwise, so as to offer a great resistance. It serves to steady a small vessel, and prevents it from drifting before the wind. The word is sometimes spelt *drug*, and is undoubtedly a mere corruption of *drag*.

loss of the rudder, which was twisted off, but the captain was of course provided with a second one. The voyage was, however, far from pleasant; no reading or amusement of any kind. The only excitement that was experienced was when, upon two or three occasions, they found themselves surrounded by a shoal of whales, that spouted and blustered a good deal. Mrs. Crapo was specially afraid of the whales. When favorable winds prevailed, the helm could not be left for a moment.

The experience of Captain Crapo tends to show that a life-boat should be provided with a large surplus of buoyancy forward, and that all her various centres should be massed aft of the centre of length. The well-known yacht "America," now owned by Gen. B. F. Butler, had all her centres massed at three-fifths of her total length from the bow, and her behavior at sea is very much the same as that of the "New Bedford," particularly in the feature of rising over a wave, instead of cutting through it, though not in nearly so marked a degree. But then the "America" is very sharp forward, and her greatest breadth of beam is at the same point as all her other centres, while the "New Bedford" is quite blunt forward, and her greatest beam is forward of the centre of her length, about the same distance that all her other centres are aft.

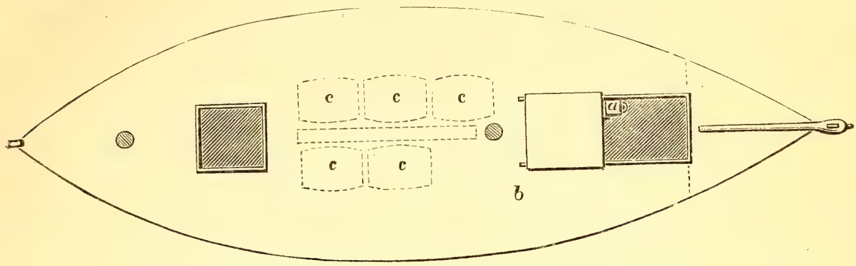


Fig. 2.—PLAN OF DECK.

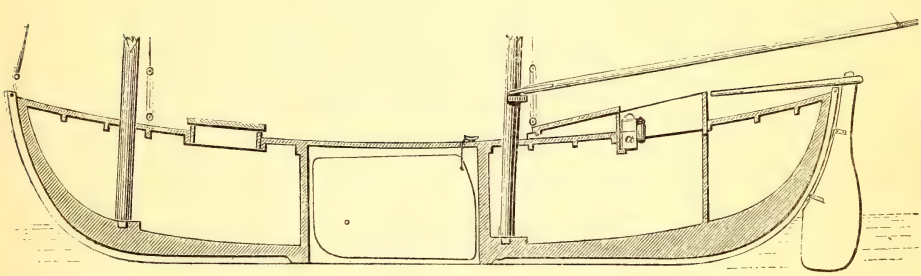


Fig. 3.—LONGITUDINAL SECTION.

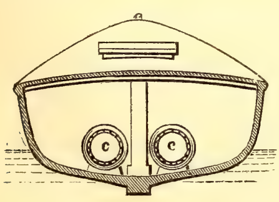


Fig. 4.—CROSS SECTION.

The "New Bedford" sailed from the town after which she was named on the 28th day of May, 1877, at half an hour after noon. The real start for the voyage across the Atlantic was, however, made from Chatham, Mass., at two o'clock on the afternoon of June 2d. She reached Penzance, Cornwall, Eng., on Sunday, July 22d, after a passage of fifty days from shore to shore.

Simple Lessons in the Art of Photography.

THE art of photography is one capable of affording a great deal of interest and pleasure, and some departments, and these, perhaps, the most pleasing, are so readily learned that we feel confident that if our readers only understood how simple it is, many of them would adopt it as a recreation. By it our summer wanderings and excursions may be enlivened, and the pleasant memories surrounding them may be perpetuated by views of the places and objects which we have visited. Truthful views of such objects as apparatus, machines, specimens of natural history, and various other objects may be taken either for transmission to distant friends, or for future reference and study. And with the advances which have of late years been made in the manufacture of simple forms of apparatus and fine qualities of material, the outfit required for commencing the practice of the art is not by any means expensive. We hope, therefore, to see ere long a large number of amateur photographic clubs organized all over the country. These clubs, by mutual intercourse between the members, will smooth the path of learners and greatly increase the interest and profit of the occupation by promoting exchanges. And we would remind such clubs that our exchange column is always open to them free of charge.

These photographic clubs are not by any means a novel suggestion. In England and Scotland they flourished extensively twenty years ago, and, we believe, many of them are still existing in a prosperous condition. In order to give those of our readers who have a taste in that direction an opportunity to make a commencement, we propose to explain in simple terms the principles of the art, and the rules for putting them in practice.

The art of photography depends for its success upon the changes which light produces in certain chemical compounds—particularly the salts or combinations of silver. These photographic effects of light are, however, produced with great power by but one of the three beams into which a ray of white light may be separated by a prism. These three beams give rise to the colors known as yellow, red and blue, and it is the blue ray that possesses in the highest degree what is called the actinic, or chemical power. The red ray is not nearly so efficient, and the yellow ray has scarcely any chemical power at all. Consequently, a room may be almost dark, from being feebly illuminated with powerful blue rays, and yet be very powerfully lit up, photographically speaking; while another may be quite well lighted, so far as mere vision is concerned, and yet be photographically dark, from the fact that the rays of light are all yellow, the blue rays having been excluded. These facts are very important, as we shall see when we come to give directions for arranging the work room, or *dark room*, as it is generally called.

Of the numberless processes for producing pictures, we propose to describe only one particular method, the collodion process, which is not only easily understood, but which also produces, with a comparatively small amount of study and experimentation, the finest results.

Pictures by the collodion process are taken either on glass or ferro-plates. They are called positives or negatives, according to the degree of exposure and development to which they have been subjected. Good ferrotypes or pictures taken on ferro-plates, are always good positives; but a good negative would make a poor positive. In a positive the collodion film is thin, and the silver deposit rather transparent, so that reflected light will clearly show all minute details. A negative is a positive to a certain extent, but the deposit of silver on the parts acted on by light is considerably denser, and the details of the picture can only be detected by transmitted light.

Beginners in photography should commence by making positives, either glass positives or ferrotypes, since this process con-

sists only of a small number of successive operations, and the final results are instantly obtained; while to make negatives and print from negatives demands the full and complete mastery of making positives, and in case of failure offers the experimentalist too wide a range in which to search for the causes of his disappointment. The hand must be trained to certain manipulations and motions, the eye must learn to observe and judge, and the necessary discipline of the two organs is most conveniently acquired in the simple process of making positives.

The apparatus and materials necessary to make positives are: 1. Camera with its lens. 2. Plateholder. 3. Tripod. 4. Bath. 5. Dipper. 6. Several wide-mouthed bottles. 7. A large and a small funnel. 8. Set of scales with weights. 9. A black focusing cloth about 1 yard square. 10. Glass plates or ferro-plates. 11. One yard of canton flannel.

The chemicals necessary are: 1. Bromo-iodized collodion. 2. Pure nitrate of silver. 3. Iodide of potassium. 4. Protosulphate of iron. 5. Acetic acid. 6. Hyposulphite of soda. 7. Alcohol. 8. Filter paper. 9. Rotten stone. 10. Shellac varnish. 11. Bicarbonate of soda.

The preparatory operations which are required before the plate can be exposed, must be conducted in the dark room, in order to retain the sensitiveness of the iodized silver film. The term *dark room* is to a certain extent a misnomer, since the dark room is not at all a dark room. At the commencement of this article it was stated that the actinic force of light is found mainly in the blue rays, while the yellow rays possess hardly any chemical properties. It is therefore only necessary to exclude all blue and red rays of light, and work with the illuminating power of the yellow rays. If we have a dark room with several windows, all the windows, with the exception of one, should be blocked out or darkened with some opaque material, for instance, three or four layers of dark-brown paper or black oilcloth. The remaining window is covered with four folds of yellow calico. This yellow curtain need not cover the whole window, but only two or three panes, provided the others are darkened in the manner just described.

In place of this modified daylight, gas or lamp light can be used. In this case the chimney or globe is surrounded with a yellow paper screen. Another very practical way is to paint three-quarters of the circumference of the chimney a dark yellow, with an alcohol varnish, to which iodine has been added till the desired color is obtained. By the latter arrangement white or yellow light can be thrown at will on the plate under operation. Have the dark room neither too dark nor too highly illuminated. In the former case you will not be able to watch the progress of the different operations; in the latter case all your pictures will be covered with an impenetrable veil.

The dark-room should be provided, near the window or lamps, with a table or strong shelf, on which to place the necessary chemicals and materials.

A good supply of water is also indispensable. For washing smaller plates the washing bottle, Fig. 1, answers very well. It is constructed in the following manner: Take a wide-mouthed bottle, of a pint capacity, with a tightly-fitting cork. The

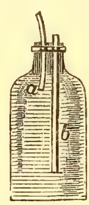


Fig. 1.

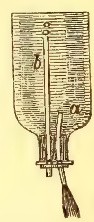


Fig. 2.

cork must be twice perforated to receive two glass or tin tubes, a short one, a, and a long one, b. As soon as the bottle is turned upside down, as seen in Fig. 2, tube b acts as a ventilator, freely admitting air, while out of tube a a continuous stream of water will flow.

For larger plates greater quantities of water are required. A very simple arrangement is to take a common waterpail, Fig. 3,

and drive into it, near the bottom, a wooden faucet, whose spout is covered with a piece of muslin or flannel to prevent impurities

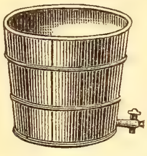


Fig. 3.

from passing upon the plate. Another vessel to receive slops, and a towel to dry the hands, will complete the furniture of the dark room.

To be continued.

Simple Legerdemain.

THE simple piece of apparatus, which is shown in the engraving illustrating this article will enable any one to perform

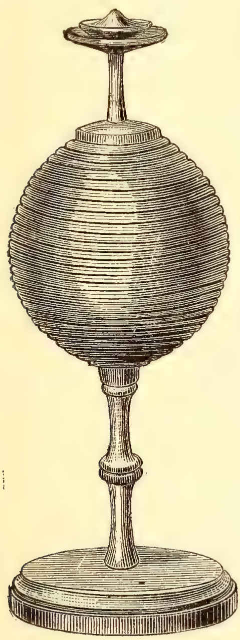


Fig. 1.

a little bit of legerdemain which will surprise almost any one that is not familiar with it. The construction of the apparatus itself constitutes a capital exercise for those who wish to become expert in the use of the turning lathe, and in succeeding numbers we will give minute directions for making it. Meantime we will give a description of its general construction and the method of using it.

Fig. 1 shows the apparatus as it appears when together. At first sight it would seem to be made out of a single piece, and as the entire surface of the oval part is finished off

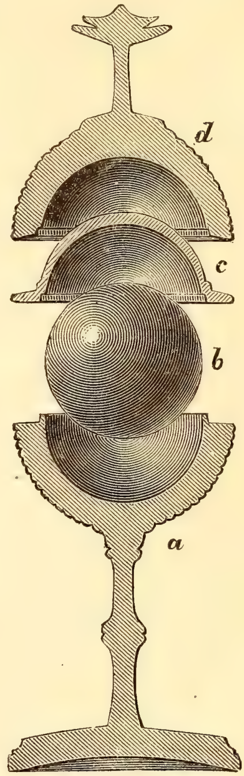


Fig. 2.

with a series of rings, the joints are invisible. In reality, however, it consists of four parts, as shown in Fig. 2: 1, the base and cup, *a;* 2, the ball, *b;* 3, the shell, *c;* 4, the cap or cover, *d.*

Suppose now that we wish to puzzle some of our friends. We must carefully conceal from them the existence of the shell, *c*, for it is upon this that the entire puzzle depends. The hollow part of this shell is an

exact imitation of the under or concave surface of the cap, *d*, and the upper or convex part is painted so as to exactly resemble the ball when it is sitting in the cup of the base, *a*. Let us therefore suppose that all four parts are together. We lift off the cap and the shell together, by taking hold of the edge of the latter. The ball is then seen in the cup. We remove it, replace the cap, and offer to pass the ball into the cup without taking off the cap. We then pretend either to drop it down from the top or to pass it up from beneath the table. The cap alone is now removed, leaving the shell in its place, and those present apparently see the ball in the cup. The cap is now replaced and an offer is then made to pick the ball out of a hat or pocket, or out of a lady's lap. The real ball is conveyed dexterously in the hand, and exhibited at the required place; the cap and shell are then removed together, as at first, and the cup is found empty!

Several variations may be made in the way of performing the trick, but under any circumstances it is very difficult for the uninitiated to detect it, and to those who see it for the first time, and who are not accustomed to such things, it looks like a veritable piece of *diablerie*.

It is not very difficult to make, but requires patience and delicacy of touch, and we know of nothing which will serve better to improve the amateur turner than the making of this little apparatus.

The Toad and its Habits.

Formerly the toad was considered a venomous reptile, but in our days its habits have been more carefully observed, and its great value to the pomologist and gardener has been fully established, on account of its propensity for destroying insects, especially those injurious to vegetation. We should, therefore, sedulously cultivate the friendship and crave the assistance of the insectiverous reptiles, including the snake, as well as that of birds.

Every tidy housewife detests the cockroach, mice, and other vermin. Two or three domesticated toads would keep the coast clear of these, and would be found more desirable than a cat, as they are wholly free from trespassing on the rights of man as does the cat. The toad is possessed of a timid and retiring nature, loving dark corners and shady places, but under kind treatment becoming quite tame.

Many instances might be cited of pet toads remaining several years in a family, and doing valuable service with no other compensation than immunity from persecution. All that is necessary to secure their co-operation, indoor or out, is to provide them with cool and safe retreats by day, convenient access to water, and they will go forth to the performance of their nocturnal duties "without money and without price."

In Europe toads are carried to the cities to market, and are purchased by the horticulturist, who by their aid are enabled to keep in check the multiplication of the insect tribes which prey upon their fruits, etc.

No one can study the anatomy of this reptile without being convinced of its perfect adaption to the sphere which it fills in the economy of nature. Its tongue, which is capable of great elongation, is attached to the anterior portion of the lower jaw; its free end, when the toad is in repose, reaching down to the borders of the stomach. The moment the toad sees its prey, its eyes sparkle, its toes twitch, and quicker than the eye can follow, the insect is transfixed and conveyed to the stomach of the captor.

— A writer in the *English Mechanic* says that the oil which he has found to remain longest fluid and free from acid, is neat's-foot oil, which has been carefully purified by hanging strips of lead in it, and exposing it to a strong light. Several weeks exposure to direct sunlight are required to accomplish this. Olive and other vegetable oils contain too much vegetable albumen to be suitable.

THE

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Concerning Ourselves.

A FEW days ago there fell into our hands a copy of a journal which professed to occupy ground somewhat similar to our own. It consisted of eight pages, one of which was advertising, one was devoted to a story, two to practical matters, and four were wholly occupied with puffs of the editor, the publisher, and the journal itself! We do not propose to follow this example. At the same time, however, a few words may not be inadmissible.

We are happy to be able to say that the reception accorded to our first number has been such as to assure us that the YOUNG SCIENTIST meets a well defined want, and that it will receive such support as will enable us to improve it constantly, both in matter and illustrations. As evidence of this, our readers will notice that the present number has been increased by four pages of reading matter.

That the YOUNG SCIENTIST is not yet anything like what we hope to make it, we freely confess. It must be remembered, however, that in order to *make* a good journal we must *have* a good journal, for it is only a good journal that can attract to itself the necessary material. Old contributors have to be trained to our special methods and wants, for we have already had abundant evidence that although men may write successfully for other journals, they cannot, without special effort, produce articles which we regard as suited to our columns. New contributors must be taught by the example of articles already published, and this presupposes an established journal.

Our object is to make this journal a practical guide to the young scientist, in the laboratory and the workshop. We hope to interest him by new experiments, new tools, and new apparatus, or at least by new and simple directions for making and using old ones, and we hope to cover such a wide range that, from the boy who has only a jack-knife for whittling, to the professor who desires to study the construction of his apparatus, all will get their fifty cents worth out of our pages during the course of the year.

A Good Watch for a Dollar.

WE have so much faith in the skill and intelligence of our American mechanics that we believe that if any one were to ask for bids for a contract for five million watches, capable of keeping time to within two minutes per week, and enclosed in neat nickel cases, with a stem-winding arrangement, he would have his order filled at a price which would enable him to sell the watches for one dollar each. At present, however, there are no such watches in market, and yet we see constantly advertised, "Good time-keepers, with steel works, for one dollar." What are they?

They are twenty-five cent pocket compasses, with a small brass gnomon for a sun dial. The steel "works" consist of a simple steel magnetic needle, and the whole affair will indicate correct time, provided the sun is shining and the observer is very skilful. These "perfect time-keepers" are perfect frauds, and yet advertisements offering them for sale are to be found in many of our most respectable papers.

They are a fitting companion to the Lefevre Diamonds or Brilliants, against which we cautioned our readers in a previous issue. Next!

Will it Show the Animalcules in Water?

THE first question always asked when a beginner is about to buy a microscope is, "How much does it magnify?" The second as invariably is, "Will it show the animalcules in water?" Let us try to answer the latter question in such a way that the young microscopist may have a clear idea of what he ought to expect.

Pure water contains nothing that can be seen with any microscope ever made, up to the present time; no solid particles, no animalcules, no minute vegetables, no spores or germs. *Good* water, such as is ordinarily procured from wells, and such as has been obtained by carefully filtering rain or river water, contains nothing that is visible to any of the microscopes ordinarily used by our ablest scientific men. Over and over again people have brought their instruments to us with the complaint, "My microscope is out of order, for I have carefully examined a drop of water with it, and I can find nothing!" The microscope was all right, but the owner did not know what he ought to expect.

How, then, are we to account for those wonderful pictures of "a drop of water," which we find in almost every popular book on science? Are the animalcules which are shown in them mere creatures of the imagination, which have no real existence?

The creatures ordinarily pictured as "the inhabitants of a drop of water" are in almost all cases the inhabitants of stagnant pools, and to see very many of them requires no microscope at all. More than this, however, where a so-called *drop* is shown, the book-maker almost always manages to give what would be the full complement of inhabitants for some hundreds of drops, not with the intention of deceiving, but for the purpose of making his book or picture more interesting.

That these statements in regard to the popular pictures and descriptions of a drop of water are correct, is easily proved. We have before us at the present moment half a dozen books in which such pictures are found. Selecting one of the most popular and interesting—Miss Catlow's "Drops of Water"—we find four beautiful engravings, each showing an imaginary drop of water and its inhabitants. But these inhabitants can in general only be found after the most diligent search, and in special localities. We might search the water from a dozen ordinary wells before we succeeded in finding any of them. Many of them can only be found in clear, though stagnant pools, while others must be looked for in water which contains decaying animal and vegetable matter. And of all the objects shown in the four "Drops," there is not one that cannot be clearly seen with a microscope magnifying one hundred diameters. Even a good hand magnifier, such as those now commonly sold in hard rubber, and consisting of three lenses, will show their outlines and forms, so that they can be recognized. It is these objects which are usually known as "animalcules," and in general it is much larger creatures (water fleas and the larvæ of insects, for example) that are exhibited by sidewalk showmen under this name. A favorite subject with such exhibitors are the eels in paste or vinegar. Both these objects, as well as the water-fleas, and even the *Volvox Globator*, or beautiful "globe animalcule," as it is popularly called, may be seen by the naked eye, *if properly illuminated.*

We must remember that these minute forms of life differ as widely in size as do the larger animals with which we are more familiar. The whale and the minnow do not differ more in size than do some of the living creatures which are the subjects of study under the microscope, and the largest of which are barely visible to the naked eye. To see the very smallest animalcules, the very beginnings of life, if we may so speak, will severely tax the power of the very best microscopes. But, on the other hand, any good magnifier—such as may be had for a couple of dollars—will enable us to see hundreds of the most interesting animalcules in water.

Laboratory & Workshop

[Specially written for the YOUNG SCIENTIST.]

The Art of Sharpening Edge Tools.

By JOSHUA ROSE, M. E.

NO. II.

Our next example shall be the sharpening of a pair of scissors, which is a fair representative of a class of severing tools which operate by a concentration of pressure upon a narrow section of the material to be separated, rather than by the acuteness of the edges. Suppose, for example, that we open a pair of scissors, and, placing a sheet of paper upon a table, or upon a piece of board, attempt to cut it with one edge of the scissors used as a penknife blade. We shall find that, with both considerable pressure and motion, it will be difficult to cut the paper, even though the scissor edge is in excellent order. This teaches us that the action is not purely one of cutting on the wedge principle, and leads us to a consideration of the difference between cutting and shearing.

Cutting instruments act by reason of the fineness of the edge which enters the material, and which, acting as a wedge, divides the substance operated upon; they are therefore dependant upon the fineness of the entering end of the wedge (as the cutting edge may be properly termed) in a far greater degree than is the case with shearing tools. Hence, in the former, strength is much less important than in the latter. The reason for this we may very readily perceive by a little investigation. Suppose, for example, that we take a piece of wood and cut it slowly with a knife; we shall find that in the beginning of the operation the edge enters the wood very easily, but that the resistance increases as the knife blade enters. This is because we have at first to sever the fibres of the wood only, while afterwards we have to continue that severing process, and also to force the already severed portions asunder to allow the thicker parts of the wedge or knife blade to pass. We have thus, to a certain extent, the strength, as well as the resistance to severance of the material, to encounter. If we rest the back of the knife blade upon a support, such as a table, place the piece of wood upon the edge of the knife blade, and then press another knife edge upon the top of the wood, with the two knife edges exactly facing each other, each edge will enter easily at first, because the separation of the fibres is the only resistance offered; but as the knife blades enter, the friction between the sides of the severed wood and that of the blades will increase until it absorbs the greater part of the power applied, teaching us that for shearing duty the angles of the side facets forming the cutting edge should stand at a right angle to the surface of the work, so that the latter shall not rub against them after severance. This then determines that the side facets of each leg of the scissors shall stand at least parallel with the line of motion of the legs when in use. In actual practice we shall find that these side facets have a little clearance, being ground away as the cutting edge is receded from in the width of the leg, so that when the edges, at any point, are in contact, the side facets form an obtuse angle one to the other. In addition to this, there is given to these faces a slight twist in their planes, and a curve in their lengths, whose usefulness will be hereafter explained.

We may now consider the angle necessary to what may be called the top facet of the cutting edges—that is to say the narrow surface (at the cutting edge) which stands at about a right angle to the line of motion of the scissor legs when in use, and this is of the utmost importance. In a pair of scissors, the material to be cut is generally weak and pliable; hence it will give way whatever be the angles of the faces, so that all we have to do is to consult the best angles to produce the required cutting edge. The action being that of a wedge, it would appear that the more acute they are the more easily they would cut; this, however, is not the case, for the following reasons.

It is obvious that the substance is severed at the point of contact of the scissor edges, and that if those edges become rounded the pliable material will be apt to spring the legs apart and slip between them; hence we have to consider the angle that will best enable the edge to resist becoming rounded, while at the same time give an edge sufficiently acute to cut. Let it be remembered that the distance of the ends or points of a pair of scissors from the joint which holds them together, enables very little pressure at the points to spring them apart; hence as the edge becomes dull, or the end becomes rounded, the points *do* spring apart, the substance or work passing between their side

faces. Now, the more acute the angles of the faces forming the wedge, the easier its edge will break off, abrade away, or bend over. Hence it is found best to make the top facet stand at an acute angle of about 4° or 5°, or, in other words, at very nearly a right angle to the side face of the leg.

We have now to consider a very important point in scissor grinding and sharpening. The distance of the scissor points from the joint which holds the legs together, renders very little pressure at the points sufficient to spring them apart, and slide past the work; hence the scissors may be tight enough at the joint to cut well near the joint, and yet not cut at the points, although the edge may be equally sharp from end to end of the edge. To obviate this difficulty, and to cause the cutting edges to fairly meet, the side faces of each leg are curved in their lengths, so that when the legs are open and we look at them edgewise, they appear to cross each other; as a result the more we close them the more the edge of one is pressed to that of the other, and this compensates for the increased distance from the joint. Now if the joint of the scissors becomes loose, a pressure of the fingers must be relied upon to keep the edges in contact as the legs close. From these considerations we may perceive that, if, to sharpen a pair of scissors, we grind them on the side faces, we destroy or remove the bend in the length of the legs; hence the top or narrow faces *only* should be ground, unless, indeed, the legs are taken apart, and then we may grind the side faces, but even in that case it is not desirable to do so, because the proper amount of curve and twist upon those faces requires a good deal of experience to determine, and we are not likely to improve upon the practice and experience of the original manufacturer, who has made the matter a special study. Furthermore a very little error in grinding the surface of the joint will have considerable effect at the points, making them come together with too much or too little side pressure; hence it is always safer and better to grind the narrow faces only. A loose screw or rivet is a great defect in scissors, but if the joint is to be tightened by rivetting, the legs should be opened wide while using the hammer, otherwise the edges will be damaged at their point of contact. If the joint is a close fit, scissors may be sharpened to some extent by simply rubbing the narrow face or facet with a narrow surface of steel as the back of a knife blade, which will throw over a coarse wire edge.

Some of my young friends may say, "Does it require so many words to tell how to sharpen a pair of scissors?" To such I answer, yes it does, if the learner is to have such a knowledge of the subject as to make him *feel* that he knows *how*, and not be liable to adopt some wrong plan, which somebody else may say will answer. There are right and wrong ways to do everything, and the only way to eliminate the wrong ways is to show the principles governing the right ones. Then we shall know *why* as well as *how* the results are obtained, the *why* being almost or quite as important as the *how*.

Mechanical Genius.

I know at least a score of men who, though intelligent enough in other respects, do not know how to drive a nail in a workmanlike manner. As boys, they were educated with a view to practicing certain vocations or professions, and mechanical arts were completely ignored by their unwise parents or guardians. Now, it is essential to every man—lawyer, preacher, physician, merchant—to know some of the principles of mechanical art, and how to apply them, for no one leads an industrious life without frequently seeing the use of such knowledge. There are certain mechanical rules that apply to almost every piece of work that man attempts to perform, from the folding of a paper to the matching together of two boards, and the bungling manner in which these things are generally done, shows how little idea men have of mechanism. Then, fathers, whether city men or country men, fit up a workshop for your boys. A small set of tools of the best material will not cost much—not more than ten or twelve dollars at most—and they will soon return you thrice their value in good accomplished. Where there is a comfortable workshop, supplied with good tools, the boys are seldom known to leave it upon leisure days to loaf in the streets. If nothing else is given them to do, they will be manufacturing wind-mills, sleds, weather-cocks, hand-carts, etc., and every hour thus employed adds to their skill as workmen. Very soon they will be able to make rainy days as profitable as

others, repairing or making very many important fixtures about the house. We know boy mechanics who have furnished their homes with brackets, flower-stands, step-ladders, and a hundred and one other things convenient and valuable.—*Exchange.*

Cheap Stage Forceps.

The stage forceps is one of the oldest accessories of the microscope, and unless we are provided with other and better appliances, it is one of the most valuable. In examining small opaque unmounted objects, such as leaves, insects, minerals, shells, etc., it is often impossible to get along without it.

A few days ago a young friend, who had derived great pleasure from a five dollar microscope, felt the want of a stage forceps, and set out to buy one. He found none for a less price than $2.25, and the most of them he could not use at all with his instrument without having it specially fitted. To pay $2.25 for an accessory for a $5.00 microscope seemed rather disproportionate. In this dilemma we set to work to make a substitute, and succeeded so well that our ten-cent stage forceps proved quite as efficient, and a great deal more convenient than those usually sold in the shops.

The engraving, of which Fig. 1 is a perspective view, and Fig. 2 a section, explains its construction. We took a wooden slide, and through the centre we bored a hole three-quarters of an inch in diameter. At one end we bored another hole to allow a small screw to pass through easily, and countersunk the lower side of the hole so that the head of the screw might not project beyond the wood. This screw fastened the cork, C, so that it might turn steadily, like a post, and yet have no shake. Through the cork we passed a darning needle, on the end of which was stuck a small cork. The cork was prevented from either turning round or coming off by means of a common pin thrust through it, and through the eye of the darning needle. The whole thing can be made by any boy or girl.

To use it we dipped the point of the darning needle in Canada balsam or mucilage, and touched it to the article to be examined. The small objects usually examined are held quite firmly by this simple contrivance, and may be exposed to the light in any direction by turning the needle round by means of the cork handle.

The cork handle itself is of great use in the examination of cabinet specimens of insects. They may be taken out of their cabinets, and the pins by which they are held may be stuck in the cork, after which they may be turned round in any way and examined. To remove them from their own pins spoils them, and if the pins are simply stuck in a wooden slide, the insects cannot be examined on all sides.

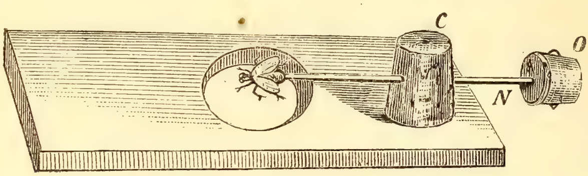


Fig. 1.

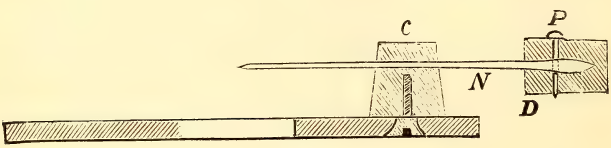


Fig. 2.

The screw, S, being fitted loosely to the slide, and firmly to the cork, C, the latter can turn freely, as on a pivot. If the screw should get loose in the cork, it may be heated and cemented in firmly with a little sealing-wax. The wooden slide is placed under the clips of the stage, and moves about like a common glass slide. This is on the plan of the forceps-carrier, described at page 94 of "Practical Hints on the Selection and Use of the Microscope."

The large hole allows light to pass from the mirror for the illumination of transparent objects. In examining opaque objects, it is well to place a black card beneath them.

How to Measure the Magnifying Power of Microscopes and Telescopes.

There is probably no class of observations in which the senses are so likely to be deceived as in estimating the magnifying power of microscopes and telescopes. It is not uncommon to find lenses of moderate powers condemned on the one hand as greatly less powerful than they really are, and on the other hand extolled as something wonderful. Thus we see in our streets cheap microscopes of very moderate power advertised as the most extraordinary instruments, because they show the eels in paste, while just as often it happens that really good microscopes, of much higher power, are condemned as weak, because, having been applied to the examination of objects with which the observer is familiar, they do not reveal any very extraordinary features.

The real facts in these two cases are that the eels in paste, provided they are well illuminated, are quite visible to eyes of ordinary keenness of vision, while ordinary objects, if carefully studied under low powers, reveal many features which are not to be seen at a casual glance, or even by the most careful study by the naked eye.

The fact that when our senses are not guided by accurate means for measurement they are very unreliable guides, will, nine times out of ten, be shown by the following experiment: Take a common opera or spy-glass, magnifying five to fifteen times, and allow some of your friends, who are unaccustomed to astronomical observations, to look through it at the full moon. In all probability they will declare that the glass does not magnify at all, but that, in fact, while the moon appears a little brighter and clearer, it seems rather smaller than otherwise! After having made this examination thoroughly with one eye, the other having been kept closed, let the person who has been observing now look at the moon through the telescope with one eye, while the other is kept open and also directed to the moon. The obvious difference in size will be perfectly astonishing. The moon seen through the telescope will now appear magnified to its full extent, and the fallacy of the first observation will be apparent.

This simple experiment, in which the observation is made by what is known as *double vision*, one eye being aided by the instrument, and the other eye observing the object without any such aid, is the first step towards an accurate measurement of the magnifying power of any glass. For if we could count exactly the number of times that the magnified image is larger than that which is unmagnified, it is evident that we would have an exact expression of the magnifying power. To do this with the moon is not very easy, unless we have instruments which are specially adapted to the work. Let us therefore turn our telescope or opera glass to a brick wall, in which the individual courses are distinctly marked. The distance at which we should stand from it should be as great as possible, provided we can see and count the courses of bricks clearly. If we now look at the wall through the telescope with one eye, and directly with the other eye, we will find that each course of bricks, as seen through the telescope, covers several courses as seen without it, and it will be easy to bring the magnified image of one of the courses into such a position in relation to the unmagnified image that we can count exactly how many of the latter are covered by the former. Let us suppose that the number is five, or, in other words, that one brick seen through the opera glass covers exactly five as seen with the naked eye. In this case the magnifying power of the opera glass is obviously five diameters.

By this simple method it is easy to determine the magnifying power of common telescopes and opera glasses with sufficient accuracy for all ordinary purposes, but when we come to apply this system to microscopes, the conditions are so different that special appliances and methods are necessary. These we propose to consider in our next issue.

Characteristics of Various Woods.

An exchange gives some interesting items concerning the commercial value and properties of the better known woods:

Elasticity.—Ash, hickory, hazel, lancewood, chestnut (small), yew, snakewood.

Elasticity and toughness.—Oak, beach, elm, lignumvitæ, walnut, hornbeam,

Even grain (for carving or engraving.)—Pear, pine, box, lime tree.

Durability (in dry works).—Cedar, oak, poplar, yellow pine, chestnut.

Building (ship-building).—Cedar, pine (deal), fir, larch, elm, oak, locust, teak. Wet construction, as piles, foundations, flumes, etc.—Elm, alder, beech, oak, plane tree, white cedar. House building.—Pine, oak, whitewood, chestnut, ash, spruce, sycamore.

Machinery and millwork (frames).—Ash, beech, birch, pine, elm, oak. Rollers, etc.—Box, lignumvitæ, mahogany. Teeth of wheels.—Crab tree, hornbeam, locust. Foundry patterns.—Alder, pine, mahogany.

Furniture, common.—Beech, birch, cedar, cherry, pine, whitewood. Best furniture.—Amboyna, black ebony, mahogany, cherry, maple, walnut, oak, rosewood, satinwood, sandalwood, chestnut, cedar, tulip wood, zebra wood, ebony.

Of these varieties, those that enter chiefly into commerce in this country are, oak, hickory, ash, elm, cedar, black walnut, maple, cherry, butternut, etc.

BOOK NOTICES.

The Art of House-Painting: Being a Clear and Comprehensive Record of the Observations and Experiences, During Many Years, of a Practical Worker in the Art, and Designed to Instruct and Assist in the Every-day Work of Painters and Others. By John Stevens. Price 75 cents. New York: John Wiley & Sons.

This work is eminently practical, the directions being plain and easily followed. It is intended quite as much for farmers, householders and others as for professional painters. It touches upon almost every point that is likely to occur in every-day practice, from the selection and care of the brushes and material to the application of the paint, and must prove very generally useful.

St. Nicholas. It is no exaggeration to say that this is the handsomest and brightest paper for young folks now published in the English language. We never yet saw a family of children to which a copy of "St. Nicholas" did not carry unmixed delight. Twelve such seasons of pleasure can be had for $3.00, and the publishers have taken a sensible and effective way of doing good by offering to give, for three new subscribers, a copy to any poor, sick or crippled child, whose name may be sent at the time of sending in the subscriptions. Those of our young friends who have kind, warm hearts, can find no better way of conferring happiness. Address Scribner & Co., 743 Broadway, New York.

Popular Science Monthly. The March number of this valuable journal is at hand, and is filled with interesting and important matter. The "Popular Science Monthly" is not in any sense a technical journal; it rigidly excludes those articles which are suited only to the wants of the professional specialist. But as an exponent of scientific progress, it is undoubtedly the best (we had almost said the only) journal for the people at large. Those who do not make science the business of their lives, but who yet desire to keep *au courant* with the scientific thought and work of the day, cannot afford to be without the "Popular Science Monthly."

EXCHANGES.

In this column yearly subscribers who may wish to *exchange* tools, apparatus, books, or the products of their skill, can state what they have to offer and what they want, *without charge.* Buying and selling must, of course, be carried on in the advertising columns.

Wanted, a small turning lathe, about 1½ inch swing, and 12-inch bed; must be well made; books and apparatus in exchange. R. M., care of this journal.

Wanted, a copy of Holtzapfel's "Mechanical Manipulation." State what is wanted in exchange. E. W., Box 4875, New York.

Wanted, a good aquarium, medium size. State what is wanted in exchange. R. H., 8 Beekman Place, New York.

Publisher's Department.

Sign Your Name Plainly.—Very few persons can write a signature so that it can be read. We involuntarily get into the habit of writing our names rapidly, and the result is that our correspondents cannot read them. Attempts have been made to obviate this difficulty by means of stamps, but hitherto stamps, if good for anything, have been clumsy, bulky, and the very reverse of portable. The latest thing of this kind, however, is a pocket stamp, which can be attached to a pencil. It is neatly mounted in a nickel-plated case, and protected by a cover, and the rubber stamp gives a clear, sharp impression, which can never be misinterpreted. Another advantage is that they are very cheap. Address Scott & Co., 291 Broadway, New York.

A Substitute for Mucilage.—Messrs. Shipman & Sons, of 10 Murray street, New York, have just put on the market a very excellent substitute for mucilage. It is a thick pasty mass, of wonderfully adhesive power, much more convenient to use than mucilage, and not liable to turn sour and offensive like paste. For the editor's desk it is just the thing, and it is excellent for scrap books and similar work, as it does not render the scraps transparent.

The Young Scientist

SCIENCE IS KNOWLEDGE. KNOWLEDGE IS POWER.

A Popular Record of Scientific Experiments, Inventions and Progress

Vol. I. NEW YORK, MARCH, 1878. No. 3.

How to Read a Drawing.

ALMOST every reader of this journal will, at some time or other, have occasion to construct some machine or piece of apparatus from drawings, and it will at least be necessary for him to know how to read a drawing, even if he should not be able to make one. We propose to give just such information as will enable our readers to make practical use of any working drawing that may be placed before them.

Drawings are of several kinds, such as perspective, isometric, orthographic, etc. It will suffice here if we call attention to the difference between perspective and working drawings. Perspective drawings are similar to the engravings usually given in books. Thus, the boat, on page 15 of the previous issue of this journal is in perspective. As a very simple example of such a drawing, and of its advantages and defects, let us take two blocks of wood placed one on the other, as shown in Fig. 1. The precise arrangement of the two blocks, and the

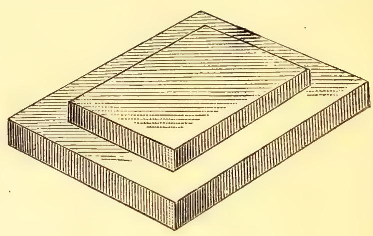


Fig. 1.

general appearance which they present are very well shown, but it would be impossible for one not thoroughly versed in drawing to ascertain the exact size or proportion of the different parts. Measured by the dividers, the further ends of the blocks are narrower than those that are nearer, and unless the reader is able to lay out the lines according to which the drawing was made, it will be

impossible for him to say whether this difference is due to actual size, or to the convergence caused by the perspective. And if instead of a simple pair of blocks, like those shown, the arrangement were a complicated machine, it would require a very expert draughtsman indeed to determine the real sizes of the different parts. This feature, which is very obvious when once pointed out, renders drawings made in perspective almost useless in the workshop.

Working drawings are therefore made according to the simplest possible system, the outlines being drawn as if the object were viewed from an infinite distance. A few illustrations will explain this better than a volume of words. In Fig. 2 the two

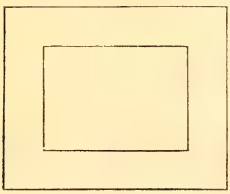


Fig. 2.

blocks are shown resting on each other, the observer being supposed to be situated at a great height above them. As seen in Fig. 2, however, it would be impossible to say whether the lines bounding the inner figure denote a hole or a projection. To avoid any such ambiguity, draughtsmen are in the habit of introducing what are called *shade lines*—that is to say, thick lines, such as are shown in Figs. 3 and 4. In Fig. 3 the outlines are shaded as if the inner rectangle represented a hole; in Fig. 4 the shading

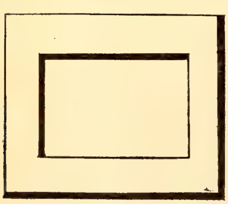


Fig. 3.

represents a projection, and the impressions made on the mind by such lining is fortunately quite definite. No one could mistake Fig. 3 for two blocks lying one on top of the other, or Fig. 4 for a block with a hole in it. Nevertheless such shading is to a

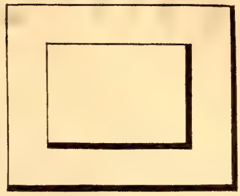


Fig. 4.

certain extent conventional, that is to say it is followed by a sort of agreement amongst draughtsmen without regard to actual light and shade, as existing in nature, for in mechanical drawing the light is always supposed to fall in one direction, which is such that the edges bounding the right hand and lower surfaces on the drawing are shade lines.

But although the reader would have no difficulty in determining that Fig. 3 is a block with a hole, and Fig. 4 a block with a projection, these figures give no idea of the depth of the hole or the height of the projection. To determine these points in this kind of drawing, other figures must be introduced. These figures are known as *elevations* and *sections*, and will occupy our attention next month.

A Good Education.

THE late Edward Everett condensed into a single brief paragraph his estimation of what constituted a good education. Here it is: "To read the English language well, to write with dispatch a neat, legible hand, and be master of the first four rules of arithmetic, so as to dispose at once, with accuracy, of every question of figures which comes up in practice. I call this a good education. And if you add the ability to write pure, grammatical English, I regard it as an excellent education. These are the tools. You can do much with them, but you are hopeless without them. They are the foundation; and unless you begin with these, not with flashy attainments, a little geology, and all other ologies and osophies, are ostentatious rubbish."

[Specially written for the YOUNG SCIENTIST.]

Wood Turning Tools.

BY JOSHUA ROSE, M. E.

THE beginner usually finds a great deal of difficulty in the use of hand tools for turning wood, the reason being that if the tool is held in a wrong position with relation to the work, it is apt to run into the material, and is sometimes even forced from the hand of the operator. If the principles governing the use of such tools be once properly understood, the merest tyro may handle them with confidence, and wood turning becomes an instructive and pleasant amusement.

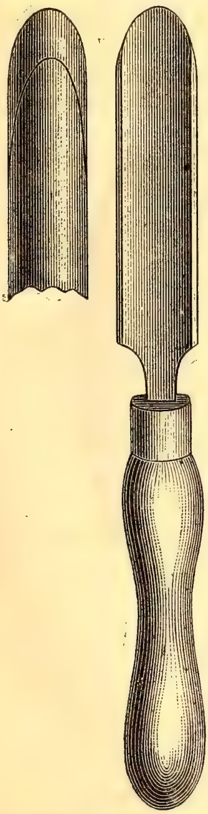


Fig. 1.

The principal tool is the gouge, shown in Fig. 1. It is used mainly to rough the work down to the shape, and nearly to the size that is wanted, leaving a little for other tools to finish, but in the hands of real experts, work may be finished very well with the gouge, rounding over corners or curves, and hollowing out sweeps with a clean and smooth finish.

The proper way to hold a gouge is shown in Fig. 2, in which the cut taken by the tool is being carried from right to left, the

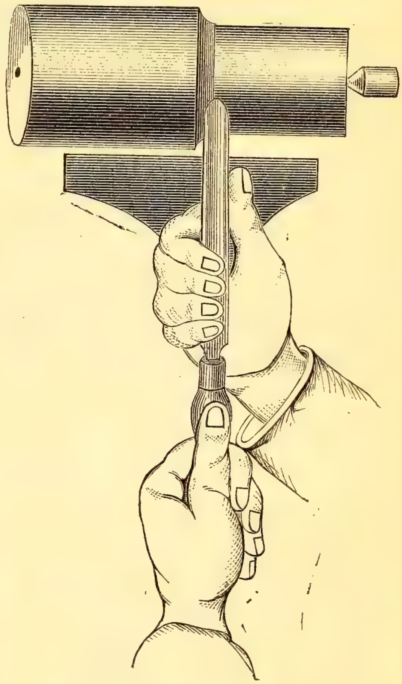


Fig. 2.

face plate of the lathe being on the left side so that by holding it in the manner shown the body and arms are as much as possible out of the way of the face plate, which is a great consideration in short work. But if the cut is to be carried from left to right, the relative position of the hands may be changed.

When the work runs very much out of true, or has corners upon it, as in the case of square wood, the fore finger may be placed under the hand-rest, and the thumb laid in the trough of the gouge, pressing the latter firmly against the lathe rest, in order to steady it. This is necessary to

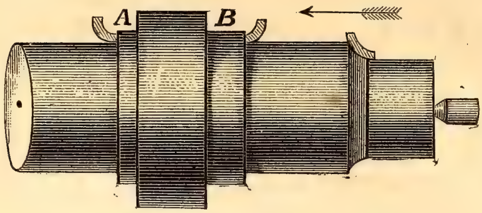


Fig. 3.

prevent the tool edge from entering the work too far, or, in other words, to regulate the depth of the cut, and prevent its becoming so great as to force the tool from the hands or break it, as is sometimes the case under such circumstances. When the gouge is thus held, its point of rest upon the lathe rest may be used as a fulcrum, the tool handle being moved laterally to feed it to the cut, which is a very easy and safe plan for learners to adopt, until practice gives them confidence. The main point in the use of the gouge is the plane in which the trough shall lie. Suppose, for example, that in Fig. 3 is shown a piece of work with three separate gouge cuts being taken along it, that on the right being carried in the direction of the arrow. Now the gouge merely acts as a wedge, and the whole of the pressure placed by the cut on the trough side or face of the gouge is tending to force the gouge in the direction of the arrow, and therefore forward into its cut, and this it does, ripping along the work and often throwing it out of the lathe. To avoid this the gouge is canted, so that when cutting from right to left it lies as shown at B, in which case the pressure of the cut tends rather to force the gouge back from the cut rendering a slight pressure necessary to feed it forward. The gouge trough should lie nearly horizontal lengthwise, the cutting edge being slightly elevated. The gouge should be ground, as shown in Fig. 1, special reference being made to the back view, where it will be noticed that the curve is ground well down the sides of the convex back, which is necessary to make the sides of the cutting edge keen and sharp.

The gouge always requires to be oilstoned, the trough being stoned with a slip of stone lying flat along the trough, the back being rotated upon a piece of flat stone and held with the ground surface flat on the surface of the stone, and so pressed to it as to give most pressure at and near the cutting edge.

For finishing flat surfaces, the chisel is

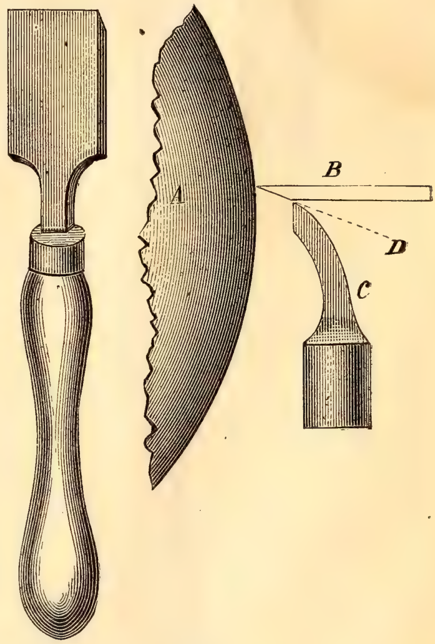


Fig. 4.

employed; it should be short, as shown in Fig. 4. It must be carefully ground, and oilstoned with the surfaces level with the stone, the surface nearest the edge being pressed the firmest to the stone. The posi-

tion in which it should be held is shown in the cut, Fig. 4, A being the work, B the chisel, and C the lathe rest. Some expert workmen hold it at an angle as denoted by the dotted line D, which makes it cut very freely and clean, but increases the liability to dig into the work; hence learners should hold it as shown.

Another excellent finishing tool is the skew-chisel, so called because its cutting edge is at an angle, or askew with the body

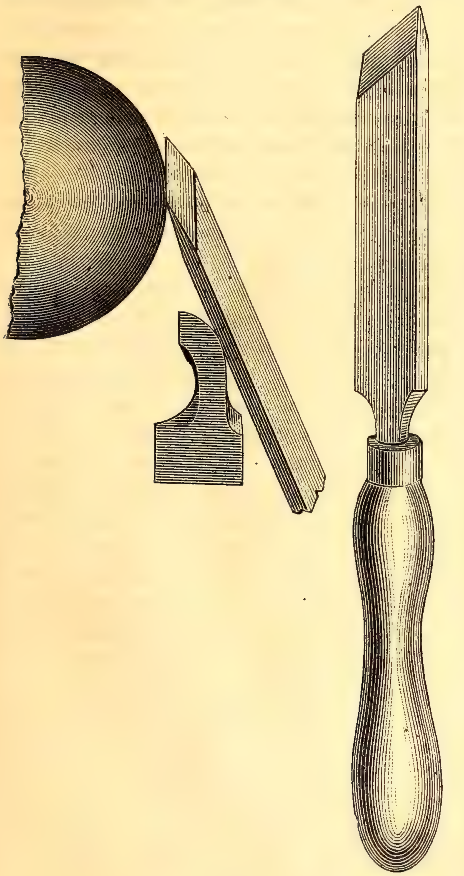


Fig. 5.

of the tool. This tool will cut very clean, leaving a polish on the work. It also has the advantage that the body of the tool may be kept out of the way of flanges or radial faces when turning cylindrical work, or may, by turning it on edge, be used to finish radial faces. It is shown in Fig. 5 by itself, and on the left turning up a globe. It is held so that the middle of the edge does the cutting, and this tends to keep it from digging into the work. The bevels forming the cutting edge require to be very smoothly oilstoned.

The whole secret of the skilful and successful use of this valuable tool lies in giving it the proper inclination to the work. It is shown in Fig. 6 at E, in the proper position for taking a cut from right to left, and at F in position for taking a cut from

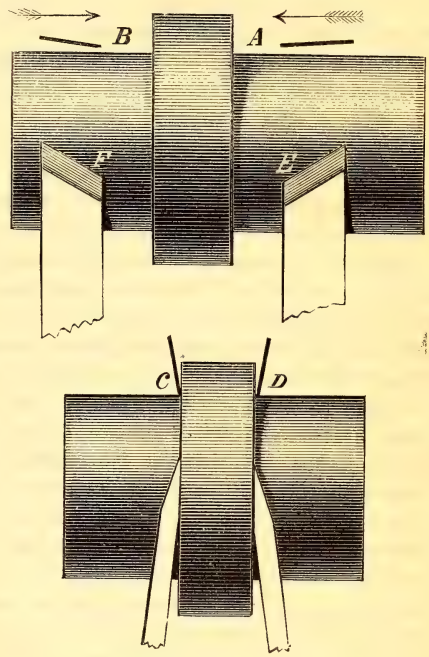


Fig. 6.

left to right. The face of the tool lying on the work, must be tilted over, for E as denoted by A, and for F as denoted by the line B, the tilt being only sufficient to permit the edge to cut. If tilted too much it will dig into the work; if not tilted the edge will not meet the work, and therefore cannot cut. For cutting down the ends of the work, or down a side face, it must be tilted very slightly, as denoted by C D, the amount of the tilt regulating the depth of

the cut, so that when the cutting edge of the tool has entered the wood to the requisite depth, the flat face of the tool will prevent the edge from entering any deeper. In cutting down a radial face the acute corner of the tool leads the cut, whereas in plain cylindrical work the obtuse is better to lead.

For cutting down the ends, for getting into small square corners, and especially for small work, the skew chisel is more handy than the ordinary chisel, and leaves less work for the sandpaper to do. Beginners will do well to practice upon black walnut, or any wood that is not too soft, roughly preparing it with an axe to something near a round shape.

What is a Diatom?

MR. CHARLES STODDER answers this question in the *Science Observer:*

I take my instrument from its case, put on a 1-6 or a 1-10 objective, and on the stage an *Aulacodiscus Oregonus* or a *Coscinodiscus oculis iridis*, and tell them to look. Then follow the exclamations: how beautiful! how mathematically regular! what exquisite lacework! Then an effort to see the object on the slide without the microscope. I take the slide off, hold it to the light, and there is nothing visible. Then follows the question, What is it? I give, perhaps, the specific name, but that conveys no idea; then I say it is a diatom. But to most people that also is without meaning (the word not being in Worcester), and the question follows, What is a diatom? That question I propose to answer here very briefly and imperfectly, for a full reply would require volumes, some of the most costly works published being devoted to the diatoms, Ehrenberg's "Micro-Geology," Schmidt's "Atlas," (now being published), to be followed by Prof. Hamilton L. Smith's great work, the work of many years.

Botanists divide all vegetation into two great groups, flowering and flowerless. Diatoms are plants, belonging to the flowerless class, or algæ. They are unicellular, *i. e.*, the whole plant is one single cell; they are all microscopic, only a few of the thousands of named species are visible to the naked eye, and then only as mere specks, but the eye must be armed with the microscope to make out the detail of the structure of the largest, while for the study of the details of the smallest forms the very *highest quality* of instrument must be used, together with a magnifying power—which is an entirely different thing from quality—that was scarcely attempted twenty-five years ago. Probably no scientific study has so much promoted the great improvement in microscopic lenses that has been made in England and America during the last thirty years as the study of these almost invisible organisms. Every advance in the knowledge of their structure or growth has produced the inquiry, Is this all, or is there something yet unseen? This could be answered only by producing lenses of better quality. The diatom cell is filled with the living matter of plants, endochrome and protoplasm, enclosed in a box of silica, secreted and deposited by the cell contents; this siliceous shell is its characteristic distinction from all other vegetable growths. The shells are beautifully sculptured with dots, lines, hexagons, and blank spaces, making them, as seen in the microscope, among the most beautiful objects of nature, always exciting an interest in those who see them for the first time, and in those who have made them the study of years.

They are found living abundantly in both fresh and sea water. Their dead siliceous shells are found under almost every peat bog; they are found fossilized in the Miocene Tertiary strata, in Maryland and Virginia, and in foreign countries; and when free from sand are used for tripoli, or polishing powder. The so-called electro-silicon from Nevada, is pure diatom shells. This article will be enough to answer the question, "What are diatoms?" but to learn more, the inquirer must first catch his microscope, and then study them in earnest.

THE

YOUNG SCIENTIST.

PUBLISHED MONTHLY.

TERMS—Fifty Cents per year. ☞ Postage free to all parts of the United States and Canada, except New York City. Our absurd postal laws make the charge for delivering our journal to subscribers in New York city five times as great as that required for transporting it across the continent, and delivering it to subscribers in San Francisco or New Orleans. We are therefore compelled to charge our New York subscribers 12 cents extra.

ADVERTISEMENTS—30 cents per line.

All COMMUNICATIONS should be addressed to

THE YOUNG SCIENTIST,

P. O. Box 4875. 176 Broadway, New York.

☞ For Club Rates, etc., see PROSPECTUS.

Unavoidably Deferred.

WANT of space compels us to defer till our next issue several valuable and interesting articles, amongst others the following: "Description of the new Speech-Recorder;" "Measuring the Magnifying Power of Microscopes;" "How to Make a Cheap Condensing Lens;" "Practical Lessons in Photography;" "Turning Metals and Hard Substances," etc., etc. The April number promises to be specially rich in interesting and practical articles.

Our Journal and its Influence.

EVERY day proves to us that our journal is needed, and that it is calculated to do much good. The bane of this country is the prevalence of demoralizing juvenile literature. A few months ago a case was brought before the courts in New Jersey, where it appeared that a dozen boys, having given themselves up to the reading of "pirate" stories and story papers, actually leagued together and formed a robber band, having headquarters, watchword, signs, grips, etc. Although the children of respectable parents, wanting for nothing, they stole provisions, etc., upon which they feasted in secret, holding orgies modeled after those of robber chiefs!

The way to counteract this tendency is to give the boys (and girls too) something to do. The children of those who are above want may dislike to commence a *bona fide* trade; to them the YOUNG SCIENTIST will point a way to intelligent recreation and active employment. Those whose means are limited will find in our pages suggestions which will enable them to save or earn many times its cost.

Does not this subject deserve the attention of those parents who have the good of their children at heart?

A New Postal Law for the Discouragement of Science.

THERE is an old proverb, which says, "*Ne sutor ultra crepidam*,"—"Let not the shoemaker go beyond his last." Why the poor shoemaker should have been selected as the proper recipient for this advice, it has always exceeded our conundrum-solving powers to find out. Our experience has been that others are more apt to transgress this sound command than are shoemakers and kindred craftsmen.

For example: Here come seven wise men from Boston—publishers all—and they have taken it into their heads that they are the only class of citizens in the United States whose welfare should be consulted in the preparation of a postal law! In this they remind us of the goose in the well-known lines of Pope:

> "While man exclaims, 'See all things for my use!'
> 'See man for mine,' exclaims the pampered goose."

To the proposed law relating to the transmission of periodicals through the mails, no objections can be made. We ourselves have, in the columns of the *Technologist*, urged the adoption of every one of them, and they are good, even if they are not original with their present advocates. In this respect the proposed law is eminently just, simple and uniform in its provisions.

But why should seeds, specimens for scientific study, or samples of goods, be charged more than *Missionary Heralds*, *Atlantic Monthlies*, or *Golden Rules?* Do not flowers exert as elevating an influence as Boston transcendentalism? Do not scien-

tific exchanges and specimens promote the diffusion of knowledge quite as much as *Journals of Education?* And yet these Boston law-givers, in their egotism and selfishness, would absolutely exclude from the mails some of the most important means of diffusing sound scientific knowledge!

That nothing which can possibly injure mail matter or post office employees should be allowed to pass through the mails, is too obvious to require more than mere statement, and consequently glass vessels, liquids, pastes, sugar, explosives, etc., ought to be unmailable. But why a microscopic object-glass, securely boxed in its brass case, or the small slips of glass used for microscopic objects, should be so prohibited, we cannot see. In England, from whose laws this section is very closely copied, these things pass freely, and out of thousands of packages thus sent, none has ever caused any injury. But in this country, under our present laws which are not so strictly worded as the proposed law, the post office authorities at Washington have decided that the smallest fragment of glass, "even if enclosed in a cast-iron box and firmly screwed up, is unmailable."* According to this, even a finger-ring, having in it a tiny lock of hair, covered with a minute glass plate, is unmailable, lest it should injure the mails!!

It is true that hundreds of postmasters throughout the country cannot be convinced that such an interpretation of the law is not an absurdity, and they constantly admit glass slides and objectives to the mails. The Boston postmaster, who was consulted in regard to the new law, admits glass slides to his mails, but when they reach New York, our authorities charge them up at double letter rates!

If the proposed law should pass and be enforced, all scientific exchanges between students of microscopy will be stopped, and the seven publishers, through whose influence such disgraceful regulations have been enforced, will have their names crystallized in our scientific literature in no very enviable connection.

The list of substances excluded is indefinite, and consequently far too sweeping. "Poisons" include almost all our minerals, and very many of our finest flower seeds; "metallic substances" include a vast number of harmless and important articles. Under this law a lady could not procure by mail a sample of buttons, if they were made of metal or had metallic eyes! It may perhaps be objected that the authorities would probably rule that such articles are mailable, but the rulings previously quoted forbid this hope. Articles having "angles" are also excluded. Indeed it would be hard to find anything that would be mailable, except the products of these publisher's shops.

The fact is, that this whole section requires careful revision at the hands of business men of sound common sense. The authors of this bill tell us that it has been prepared "after consultation with publishers in different parts of the country." But other people besides publishers use the mails and contribute to the support of the government, and we regard it as a singularly unfortunate thing that the publishers of two religious journals, and one of them a regularly ordained clergyman, should have appended their names to such a thoroughly selfish document as the one before us. A proper liberality to other interests cannot possibly injure the publishers, and is but simple justice to the people at large.

*These are the exact words reported to us as the decision of the legal advisers of the Post Office Department. The best men in the country have argued and protested in vain against such rulings. But in the words of Schiller, "Mit der Dummheit kämpfen Götter selbst vergebens."

What Will the Weather be To-morrow?

EVERYBODY, from the child looking forward to the play hour, to the farmer or man of business whose livelihood depends upon rain or sunshine, is interested in the weather, and any means which will "foretell correctly any change in the weather twelve to twenty-four hours in advance," will be eagerly sought by a very

large number of customers. Undoubtedly the most perfect system of foretelling what the weather will be is that now in use by the United States Signal Service. The prognostications made by this system depend upon the observations of a very large corps of assistants scattered over the entire country. From the reports of these assistants as to the temperature, pressure, and hygrometric or moist condition of the atmosphere, and the direction and velocity of the wind at different points, tolerably reliable conclusions are reached as to the probable character of the weather during the succeeding twelve hours at any given station. Absolute certainty is, of course, impossible, and the published results have been given as "Probabilities" and "Indications."

But what neither "Old Probabilities" or "Young Indications" would venture to assume, is now fearlessly claimed by the advertisers of a very old and worthless device which has been recently manufactured in enormous quantities and sold at exorbitant prices, chiefly to farmers. We refer to the old weather-glass, consisting of a glass tube, filled with a solution of camphor and sal ammoniac in alcohol—and tightly sealed. Under certain conditions of pressure and temperature this solution becomes cloudy, and when these conditions change, it again becomes clear. Unlike a good barometer, it is easily made, not costing over ten or twelve cents when made in quantity, and when mounted in a cheap frame, with a twenty-five cent thermometer, it is sold for from one to two dollars.

In its very best form it was carefully investigated some years ago by several very able scientific men, and shown to be perfectly worthless. It is, in short, a worthy companion to the old almanacs, which professed to foretell, months and years ahead, just what the weather would be on any given day. It is generally advertised as a signal service *barometer*, but it is not a barometer in any sense of the word. It has more of the character of a rude *thermoscope*, or heat indicator, but as the walls of the glass tube are thin, they yield when the pressure of the atmosphere varies, and the solubility of the salts are somewhat affected by this fact. It is therefore a sort of nondescript, to which no really correct name can be applied.

It has been advertised largely in the agricultural papers, and has doubtless been sold extensively to farmers, having been freely praised, even by those papers that make a virtue of decrying all humbugs. And yet a more thorough and dangerous humbug has rarely been brought before the people, simply because it has all the appearance, without any of the reality of honesty.

We therefore add it to the Lefevre Diamonds and the Dollar Watch with "steel works," described in previous issues. In our next we shall take up a fourth humbug of a scientific or a mechanical kind. These so-called scientific humbugs are the most dangerous to the community, and the safest to the originators, and we propose to pay our respects to them *seriatim.*

Laboratory & Workshop

Making Glass Apparatus.

By Romyn Hitchcock.

Few things will give the young scientist more satisfaction than a set of instruments of his own make. Some of the most useful and interesting pieces of apparatus are made of glass, and therefore a few practical directions for working in this material will doubtless be acceptable.

We must caution our readers, however, that success in this work requires a certain dexterity which cannot be attained without a considerable amount of patience and perseverance. Failure at first is almost inevitable, but much of the difficulty vanishes when one has become accustomed to the handling of glass tubing, and has acquired the knack of heating and bending without fear of fracture and of blowing small bulbs on the end.

We must have a spirit lamp, or, what is far better, if gas can be used, a Bunsen burner, and for blowing glass we should have a good blowpipe worked by the foot, although a Bun-

sen burner alone will suffice if the gas pressure is good. A good blowpipe for heating glass tubes may be made out of some pieces of glass tubing, having a bore of about one-quarter of an inch in diameter. A description of such a blowpipe, which we have found to succeed perfectly in our own practice may not be amiss here. In Fig. 1, *a* is the top of a small stand, in fact, an old washstand, bought at auction, through which are bored four holes, *b*, *b*, *b*, *b*, somewhat larger than the glass tubes to be

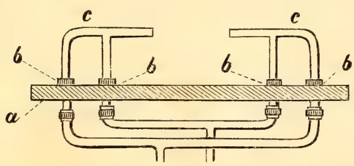


Fig. 1.

used. We select four pieces of tubing, two of them 6 inches long, and the two others about 11 inches. Join now a short one to the side of a long one, about 2½ inches from the end of the latter, so that the two will form a right angle; then bend the long tube down, and draw the short end off to a point to form the jet as seen at *c*. Do the same with the other tubes, and the two jets are made. They must be placed in the table, as shown in Fig. 1, by means of corks, which fit the holes in the table, the tubes being fitted into holes in the corks. Connect now the two inner tubes with the gas, and the two outer ones with the bellows, and the blowpipe is complete. There should be a stopcock between the bellows and each of the air tubes, to regulate the pressure. It is best to purchase a bellows, which can be had at moderate cost.

If the operator is not familiar with the method of joining a tube at right angles to another, he will perhaps find some difficulty in doing it, and will very likely prefer to simply *bend* a single tube at a right angle, and draw out a jet on one end. This will be his blowpipe, and the flame may be a common kerosene hand lamp, with a wick about half an inch wide or more, or what is still better a gas burner made with a flat top, perforated with numerous small holes, across which the jet is directed in the line of its greatest diameter. This top is well made oval, and about three-fourths of an inch long by half an inch wide.

In manipulating glass it is a great advantage to have two flames from opposite directions, which meet at an intermediate point, as much greater heat is at command, and the tube is heated much more evenly.

A few general directions for manipulating glass tubes are all that is necessary. To bend a tube, the best plan is to use a common fish-tail gas burner as the source of heat. The deposit of soot is an advantage in preventing too rapid cooling, and can be wiped off with a bit of paper or cloth. Let the tube be constantly revolving in the fingers while heating, and never attempt to bend a tube or *alter its form in any way while in the flame.* When well softened, remove from the flame, and bend slowly and steadily with the fingers at a moderate distance from the heated portion, so as to secure an even curve.

To make a good jet, or to contract the bore at any point, use the Bunsen burner, or, better, the blowpipe flame. Revolve the tube in the flame, and as it softens press gently together, so as to thicken the tube at the point heated. By a little practice a tube of one-quarter inch bore can be contracted to an almost capillary tube at any point, while the external diameter remains the same. To make a jet heat near the end and thicken in the same way, remove from the flame, and draw out slowly until the proper size is obtained. When the glass is thick enough we need simply heat and draw out, but usually the jet so obtained will have very thin walls, and hence be too fragile for service.

To blow a bulb is no easy matter at first. It is best to use a small tube with thick walls, draw it off abruptly at one end, and fuse it together. Then hold it in the blowpipe flame, and soften thoroughly, keeping the cool end down, so that some thickening shall take place. When properly heated withdraw from flame and blow quickly in the open end until the bulb is large enough. Never cease revolving in the fingers, or the bulb will be one sided. It will be one-sided any way until you know how to do it. To blow a bulb in any other part of a tube, follow the same general plan, and seal up one end or put a cork in it.

To make a "funnel tube," like Fig. 2, blow a bulb on the end of a tube, then revolve the tube in the flame, so as to heat the top of the bulb, down to the dotted line, *a b*. This

softens the upper part. Blow suddenly and forcibly, which makes the tube take the shape of Fig. 3. Break off the thin, kidney-shaped portion almost down to the line *a b* (Fig. 2),

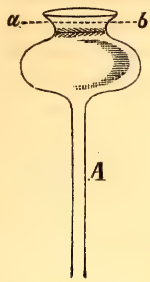


Fig. 2.

and round the edges by heat. Never use a tube for connections, or any piece of apparatus, until the ends are smoothed by heating in a Bunsen burner.

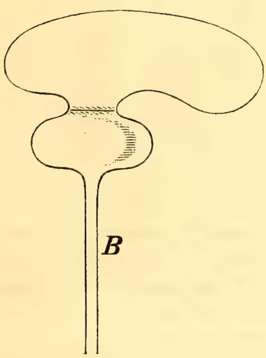


Fig. 3.

To join a tube at right angles to another, blow a thin bulb on the end of one tube, and break it off close down. This is merely to give an expanded end to the tube. On the other tube, at the point where the joint is to be made, heat intensely with a fine pointed flame, and blow out a hole in the side. The expanded end of the first tube will fit tolerably well over the opening thus made. Stop up two of the ends, leaving one open, and join the tubes by heat, blowing into the open tube to expand the joint as necessary. Do not make the glass about the joint too thick, and cool slowly. This is one of the most difficult operations to accomplish neatly, but it is of great value in many instances.

A Ten-Cent Galvanic Battery.

The interest which at present exists in regard to telephones, telegraphs, electroplating, etc., amongst young people, renders any simple and inexpensive method of constructing a galvanic battery a matter of great interest and importance to a large number. Some years ago we constructed a series of cells out of old tomato-cans, stiff brown paper, a little plaster of Paris, and some discarded sheet zinc that had served its day underneath stoves. The

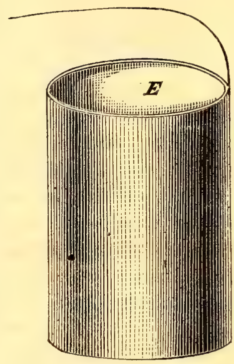


Fig. 1.

cost of the materials for each cell was but four or five cents, the cans being easily obtained for the picking up. In our present estimate of the cost of the battery, we place no value on the cans, for so long as canned fruits, vegetables and meats are consumed, the experimenter will be able to obtain this part of the apparatus without expense, and no fear need be entertained that the supply will fail, for our readers may rest assured that for every one who has brains and who will experiment, a hundred will be found who have stomachs and who will eat.

Besides the solutions, this battery consists of three parts: 1, the can, Fig. 1, which forms the outer cell; 2, the porous cell, Fig. 2; and, 3, the zinc, Fig. 3. The three parts are shown in section, arranged for work, in Fig. 4.

The can requires little or no preparation. It should be cleaned, the remains of the cover either cut off or hammered flat, so that the edge will be smooth, and a stout copper wire should be soldered to one side.

The porous cell is made thus: Procure a cylinder of wood or any other material about two inches in diameter; round it roll several

thicknesses of good brown paper, and "choke" the end a little with a cord, so as to make a contracted place at the lower end. The object of this is to prevent the plaster plug from

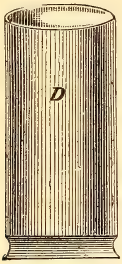


Fig. 2.

falling out, which it would do if the paper tube were smooth. Tie the paper firmly with twine, both where choked, and also higher up. Allow it to project about half an inch beyond the wooden cylinder, and in the space thus left

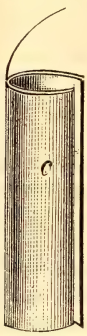


Fig. 3.

pour plaster of Paris mixed with water, in the same way that lamp dealers use it for fixing chimneys on lamps. When the plaster has set and become hard, the porous cell is made.

The zinc is simply a sheet cut to the proper size, and rolled into a cylinder. It may be amalgamated if the experimenter chooses, but works quite well without this. It must have a stout copper wire soldered* to it as shown in the figure.

The solutions required are a saturated solution of sulphate of copper (blue vitriol, a salt worth about 14 cents per pound), and a saturated solution of glauber's salts (sulphate of soda), to each pint of which two teaspoonsful of sulphuric acid (oil of vitriol) should be added. Arrange the various parts as shown in Fig. 4, where the battery is seen in section, the poles being connected by a fine iron wire which has just been fused. In this figure E is the outer can; D, the paper cylinder forming the

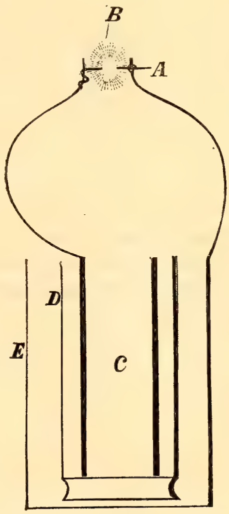


Fig. 4.

porous cell; and C, the zinc cylinder. Join the wire attached to the zinc to that attached to the can. The surfaces of the wires should be made bright where they come in contact, and they may be held together by means of a spring clothes-pin. Then fill the porous cell to within half an inch of the top with the solution of sulphate of soda, and fill the space between the tin can and the porous cell with sulphate of copper. A current of electricity will at once be set in motion, and after a short time, say, fifteen minutes, the interior of the tin can will have been completely coated with copper.

The reason for arranging the battery, and connecting the wires *before* pouring in the liquid is to give the can an opportunity to become coated by electro-deposition instead of by the chemical action of the sulphate of copper on the tin. The latter is apt to give a mere powdery coating, but the battery lays on a firm sheet of copper.

One such cell is capable of charging weakly

*The process of soldering is so frequently necessary, and it is also so simple and easily performed, that we shall give minute directions for performing it in our next issue.

an electro-magnet; it will burn off very fine iron wire (wire not thicker than a human hair), and will deposit a coating of copper on medals, etc. Two cells are comparatively stronger, and with half a dozen it is easy to send a current several hundred feet, and explode cartridges or burn wires. Such a series will make powerful electro-magnets, and will heat to a white heat a considerable length of fine platina or iron wire. It will also give quite a bright spark between two pieces of hard carbon, such as that from gas retorts. Thus, at an expense not exceeding fifty cents any country teacher who has a class in philosophy can get up a battery that will enable him to illustrate most of the experiments described in the books.

A Shower of Fire.

To those who see it for the first time, few experiments are more striking than the burning of iron, Iron is generally regarded as an incombustible substance; we make our pokers out of iron and not out of wood, because the latter burns easily, while an iron poker resists a very hot fire. Our stoves, too, are made of iron for the same reason, and when iron is seen burning fiercely it is a great surprise to most people. Dr. Priestly, the discoverer of oxygen, used to carry about with him a small flask of this gas for the purpose of amusing his friends by showing them the burning of a piece of iron, just as Wollaston, in after years, used to carry about a small battery made out of a lady's thimble, with which he was in the habit of exhibiting the ignition of a piece of very fine platinum wire.

There are several ways by which the combustibility of iron may be shown. The most common method is to set fire to a piece of watch-spring in a jar of oxygen. Another is to throw a jet of oxygen on a piece of cast iron laid on ignited charcoal. The iron fuses and burns with wonderful brilliancy, throwing off sparks until the effect is almost dazzling. We have fused as much as an ounce of metal at one time in this way. A third method is to drop iron filings into oxygen, passing them through a ring of flame, so that they became highly heated before they entered the pure gas. A fourth method is to support a mass of filings on the end of a magnet, and ignite them in a large jar of oxygen. The whole arrangement may be prepared in advance, and the filings may be ignited by passing a voltaic current through an iron wire which touches the filings. The combustion is exceedingly rapid and wonderfully brilliant.

The simplest method of showing the combustion of iron consists in suspending iron filings from the poles of a magnet, and setting them on fire with a common spirit lamp. They burn slowly but brilliantly in the open air, and as they keep falling from the magnet they form a remarkably curious and brilliant shower of fire. If the magnet be slightly tapped, the shower is increased, and if it be swung through the air a shower of fire is projected in all directions. Few experiments are more simple or more astonishingly brilliant than this.

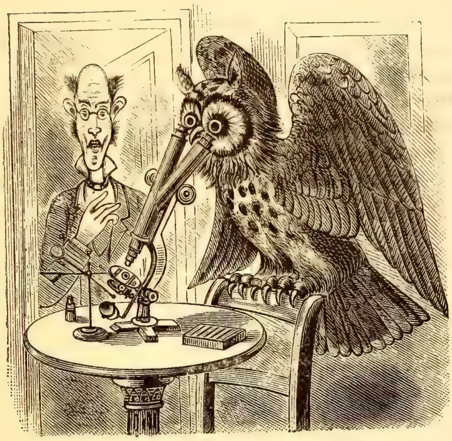
It is now nearly twenty years since this method of burning iron was described by Magnus, and yet even now it is not generally known. The reason for this is that although frequently described in books and papers, the points upon which success or failure turns has not been generally disclosed, and some of those who have understood it, have endeavored to keep it a secret. We have frequently exhibited the experiment in lectures, and sometimes, by means of electro-magnets, on a very large scale, and on every occasion it has produced a most profound impression.

The secret of success lies in the use of very fine filings. Over and over again parties have written to us, "We have tried your experiment with the iron filings, and have been unable to succeed." The fact was that they had gone to some blacksmith's shop, scraped up some of the iron filings from the bench, and used them. They might as well have used tenpenny nails. The filings must be of the finest kind, produced by the finest files. Iron in large masses resists fire very well; when in sufficiently fine powder it actually takes fire spontaneously, burning with great energy the moment it is brought into contact with the air. Fortunately, filings such as are necessary are an article of commerce, being manufactured extensively in Switzerland, and they may be procured from any large drug store.

All that is necessary is to dip a magnet in the filings, and lift as much as it will carry. The flame of a spirit lamp is then passed over the filings once or twice, so as to ignite them over the whole surface, after which they will continue to burn, and if held high and shaken, they produce remarkably brilliant effects.

We have performed this experiment upon every scale, using in some cases a small ten cent magnet, and in others a row of a dozen electro-magnets—the poles being wide apart, and the current quite strong. The magnets—were all firmly fixed to the same bar of wood, which was considerably elevated. When this bar was struck lightly with a hammer, a perfect sheet of burning iron fell down, and the effect was almost indescribable.

Microscopy.



Oh! my!!

What Power Shall we Use?

It is a very common error to suppose that in order to see anything clearly it is necessary to magnify it very much. Some things undoubtedly require very great magnifying power, but the majority of objects that are examined or studied by young microscopists are best seen with a moderate power. We must remember that when a very great magnifying power is applied to ordinary objects, we are able to see only a very small portion of them; no clear idea can be formed of the relation of the different parts, and the result is very unsatisfactory. At least 90 per cent of all the most interesting objects that are likely to present themselves to young microscopists can be seen very well by means of powers under two hundred diameters, and the range of objects that can be seen with a power of less than one hundred diameters is very large. Let us enumerate a few.

Almost all the opaque objects which are so celebrated for their beauty, can be seen with a power of twenty-five diameters. The list includes minerals, seeds, butterfly's scales, and other preparations of plants and insects. The general structure of plants, as shown by sections of stems, leaves, etc., is also well worth examination by this power. It will also show the general appearance of the larger animalcules, and of very many of the smaller larvæ of insects, as found in water.

A power of fifty diameters may be applied with good results to many of the objects just named. Such a power shows well such objects as the eels in paste, trichina in pork, the *Volvox Globator*, and many of the larger desmids and diatoms. The crystals of different salts, and particularly the active process of crystalization, are best seen under this power. The deposition of crystals of pure silver, obtained by decomposing a salt of that metal, is one of the most magnificent sights known to microchemistry.

With a power of 100 diameters, we can see the more minute structures of many of the objects named. Thus the eels in paste are seen not only as a whole, but their internal organs can be distinguished. We can also see the form of the blood corpuscles, and distinguish between the blood of the frog, the chicken and man. Some of the most wonderful sights can also be seen with this power, such as the circulation of the blood in the foot of the living frog. In short a description of the objects which may be profitably examined under this power would fill a large volume.

Paste-Eels.

Since the mention of these in our first number, we have had numerous inquiries in regard to the best means of obtaining them. It is generally said that if well-boiled paste is allowed to stand for some time, until it becomes sour, it will swarm with them. Such has not been our experience. During the summer we have kept paste until it attained every stage of decay, but no eels made their appearance, and we doubt very much if eels ever appeared in paste that had been well boiled, and had not been mixed with unboiled water. We have not been able to obtain them, except by the transfer of material known to contain them or their ova. These seems to be present in some samples of water, and when placed in paste they multiply with astonishing rapidity.

Paste eels are a very curious object under the microscope—indeed there are few objects that are more interesting to young people and beginners. They are easily raised and kept. Make a little well-boiled paste, and allow it to stand until sour. Add some old paste, containing eels, and in a short time the entire mass will be alive with them.

Our readers will doubtless ask, "Where shall we get the old paste?" We have plenty of it. Either call on us, or send a three-cent stamp, and we will

send you a sample by mail, enough to start with. Don't send stamped envelopes; also, prepare your paste before you send for the eels. The paste should be about as thick as cream. To examine them, mix a little of the paste with a drop of water on a glass slide, cover it with a thin glass cover, and place on the stage of the microscope.

Plants Growing Under the Microscope.

This is something that we read of in most books on the microscope, and although it is not by any means true plant growth, it is very curious and beautiful. Procure a little Collomia seed, which may be had from most seedsmen, but if you cannot get it easily, we will send you a few seeds, if you will send a stamp to pay postage. Take one of the seeds, and with a razor, or very sharp knife, cut off a very thin slice. Lay this slice on a slip of glass, (an ordinary slide), cover it with a thin glass cover, and, the microscope being in a vertical position, lay it on the stage. If you wish to incline the microscope, you must use a square glass cover, and not a round one, and hold the cover to its place by means of a very fine rubber ring. Now, bring the thin slice of seed into focus, and then apply a drop of water to the edge of the glass. The water will penetrate between the glasses and moisten the seed, which will at once throw out a very large number of spiral fibres—giving it the appearance of veritable germination. Beginners will find it easier to perform this experiment if one will apply the water while the other looks through the instrument. A single drop is enough.

A Sanguinary Hoax.

A few days ago a young man named Warren, of Jersey City, reported that he had shot a burglar who had dashed through the parlor window on to the porch, whence he had escaped to the street. Several spots of blood were found on the porch, which the young man insisted afforded a corroboration of his story. The police, however, suspected the truth of the young man's story, and therefore they had the blood examined by a microscopist, who pronounced it that of a bird. So this brave young man had to own that instead of killing a bold burglar, he had only killed a chicken!

Finishing Microscopic Slides.

Few things are more attractive, or afford greater pleasure to the owners than a cabinet of good slides, and the pleasure which they give is greatly increased if they are not only good as objects for study, but neat in appearance. Of late years the lides which have come most generally into favor are those of plain glass with ground edges. Paper covers are so apt to become soiled, worn and torn, that they are not much used. When uncovered slides with ground edges are used, the thin covers should be circular, and the edges, even where balsam is used, should be covered with a ring of varnish, put on with the turn-table. Some use varnish of very bright colors, laid on in rings. This looks very striking, and if the colors are well arranged they look very pretty, but one tires of them, and dull, quiet colors will be found to give the best satisfaction in the long run.

BOOK NOTICES.

The Amateur Mechanic's Practical Hand-Book. Describing the Different Tools required in the Workshop; the Uses of them and how to Use them; also Examples of Different Kinds of Work, etc., with full Descriptions and Drawings. By Arthur H. G. Hobson. Price $1.25. Philadelphia: Claxton, Remsen & Haffelfinger.

This is a small book of 114 pages, and is therefore rather a collection of useful notes upon the most important topics, than a systematic hand-book. The subjects which are discussed are: The Lathe and its Uses; Drilling and Planing Machines; the Vice, Bench and Hand Tools; Drawing and Pattern Making; the Brass Furnace and Moulding; How to Make a Horizontal Engine; Boilers. It is well illustrated, and the directions given are sound and practical. Amateurs will find it a useful assistant.

Robinson's Epitome of Literature. Monthly. $1 per year. Philadelphia: F. W. Robinson.

The extent of the current literature issued month by month is something wonderful. So great is it that no man can keep abreast of even the scientific literature of the day. It was therefore a good idea to give each month the chief contents of all the important magazines and journals published in the country, as well as a list of the books, with extended notices of the more prominent ones. In this way readers who have neither the money to spend nor the time required to labor through large piles of journals, are enabled to pick out what they want, to the exclusion of irrelevant matter. The journal before us is a welcome visitor to our table, and must prove of great value to every intelligent reader.

The Telephone. A Lecture entitled "Researches in Electric Telephony," by Prof. Alexander Graham Bell, delivered before the Society of Telegraph Engineers, Oct. 31, 1877. Price 60 cents. London and New York: E. & F. N. Spon.

Professor Bell here gives a very complete history of the telephone, and incidentally a very clear and succinct account of this wonderful invention. The lecture is very fully illustrated with wood engravings, showing the construction of the instrument at different stages of its history, and from these engravings it would be easy for any smart boy to go to work and construct a pair of telephones for himself. The pamphlet before us will prove of great interest, both to the general reader who desires to have clear and accurate ideas of the instrument, and to the amateur who desires to experiment.

Mechanical Work for Girls.

It is generally supposed that no woman can tie up a parcel, or sharpen a pencil. This we know to be a gross error. We have known girls who could handle most tools with quite as much dexterity as their brothers. A great deal depends upon training, and it will often serve a woman in good stead to be able to handle the hammer, the saw or the chisel. A recent writer in the "Country Gentleman" gives her experience thus: "Many a woman possesses as much ingenuity as a carpenter or cabinetmaker, and a little practice will teach her the upholsterer's trade, so that with nails, hammer, and the needful material, she will not only make as good a chair cushion as he, but will be able to cover a lounge respectably, and also an arm chair. Rocking chairs have often been far more comfortable than when first purchased, by the exercise of this art. In many families there are disabled chairs which have been thrown aside as useless, and yet, with but little expenditure, they could be made not only useful, but ornamental, and their presence would be a great addition to the sitting room."

Counterfeit Fossils.

A paragraph is going the rounds of the papers to the effect that the ingenious individual who manufactured the Cardiff giant, and the so-called Colorado petrified man, now comes with a startling story of previous exploits. He confesses to having manufactured the famous stone tablets of the Connecticut Valley, on which were imprinted by artificial means the tracks of supposed prehistoric birds—relics, which, it will be remembered, excited the whole scientific world. That he may have produced some of these tablets is quite possible, but, fortunately, of slabs of undoubted genuineness there has been discovered a number sufficient to sustain all the scientific theories that have been based on them.

Inquiries and Answers.

Inquiries.

3. Is there anything that will destroy the offensive odor of benzine? It is caused, I believe, by an excess of hydrogen gas. An answer to the above question will oblige. H. R. S.

4. Can any of the readers of the YOUNG SCIENTIST tell me how to preserve tadpoles while they are passing through the stages of transition to the frog? Last summer I tried several times to keep them alive and healthy, in order to observe the transformation, but always unsuccessfully, never succeeding in keeping them over a week. Fresh water, small pieces of rock, and liberal supplies of pond weed, were of no avail. An answer will greatly oblige. TRADDLES.

5. Can any of your readers give a simple direction for preserving lizards, frogs, etc., in alcohol, for future use; also, should they be disemboweled? AMATEUR.

6. Will some reader of this department inform me how to make a cement for joining glass to brass, and oblige. H. W.

7. Will some of your readers inform me of a simple dressing for meerschaum, with directions how and when to apply it, and oblige SMOKER.

Answers.

8. In answer to "Rustycuss," in the January number, I would answer him as follows, concerning the polishing of an old telescope. First, take it all apart, and polish well with the finest emery paper, rubbing only one way; then furnish yourself with a spirit lamp, a small quantity of shellac varnish, and a fine camel's hair brush (flat), and proceed to laquer it in the ordinary manner. This will prevent it from tarnishing for some time, but as time wears "on," the polish will wear off. BRASS BUTCHER.

9. In reply to "Rustycuss," I would say that if he will polish the brass work of his telescope, by running it very fast in a lathe, and applying very fine emery cloth or paper, until the desired end is produced; then warm the several parts or pieces carefully on a stove (don't get them too hot, only a little too warm to handle conveniently); then brush them over with the "Brass Lacquering" given on page 12. If well done the parts will look as good as new, and will keep a rich, clean appearance a long time. Microscopical apparatus may be finished and colored in the same manner. T. REST.

EXCHANGES.

In this column yearly subscribers who may wish to *exchange* tools, apparatus, books, or the products of their skill, can state what they have to offer and what they want, *without charge*. Buying and selling must, of course, be carried on in the advertising columns.

Two Selden's patent printing telegraph instruments; will exchange for microscope or books. Address W. Chamberlain, 446 Broome street, New York.

Specimens of the marbles, graites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. H. A. Cutting, State Geologist, Lunenburgh, Essex County, Vt.

For exchange, for a microscope, a small engine lathe (screw cutting) in nice order, costing $110. Address Dr. J. H. Convurne, West Troy, N. Y.

Thorough and practical instruction in shorthand will be given in exchange for a microscope, with or without accessories, worth from $5 to $10. Address T. P. Wendover, 68 Christopher street, New York.

Wanted, a small turning lathe, about 1½ inch swing, and 12-inch bed; must be well made; books and apparatus in exchange. R. M., care of this journal.

Wanted, a copy of Holtzapfel's "Mechanical Manipulation." State what is wanted in exchange. E. W., Box 4875, New York.

Wanted, a good aquarium, medium size. State what is wanted in exchange. R. H., 8 Beekman Place, New York.

The Young Scientist

SCIENCE IS KNOWLEDGE. — KNOWLEDGE IS POWER.

A Popular Record of Scientific Experiments, Inventions and Progress

Vol. I. NEW YORK, APRIL, 1878. No. 4.

A Simple Musical Instrument.

SOME days since, having a few odd moments of leisure at my disposal, I set about arranging a curious little musical instrument on the kitchen table. A brief description of the little impromptu affair, together with an account of its wonderful capacities, will doubtless interest many of the readers of this journal, especially those who are musically inclined. Of course I make no claim to originality in the construction of this little instrument, and yet I don't know what to call it.

In making this instrument, the first step is to turn a tiny mallet, from soft wood, on the lathe. Make it about an inch in diameter, with the ends neatly convex, and with a light handle eight or ten inches long. Then pad and cover one of the ends with soft chamois or buckskin. Now get down the family goblets—your wife or mother may object, but you will not break them—and if you are fortunate enough to be able to make your selection from a fine set of Bohemian or cut glass, it will be all the better, as the finer and thinner the glass, the better will be the tone. Set your goblets on the table, and run over them with your mallet, tapping each gently to ascertain its pitch; then arrange them in a row, beginning with the lowest toned glass, and proceed upward, according to pitch. Now take the lowest toned goblet, and fill it with cold water, which will of course lower the tone still further, and give you the lowest tone of your scale. Then take the next lowest goblet, pour in water slowly, until the sound produced is precisely a semitone above that of the first goblet; and proceed in this way, regulating the pitch of each by the quantity of water, until you obtain a scale of one octave and a half, or two octaves, or as much more as the glassware at your command will allow. You

can, of course, leave some of the goblets empty, where the requirements of pitch make it necessary; and you will find this requisite in the highest tones at least. In fact the greatest difficulty is to obtain a sufficient range or compass of tone, unless you have goblets of varied size, shape and thickness. But, having your entire scale completed in regular chromatic succession, it will be well to go over it carefully, and see that all the intervals are musically accurate; for unless it be tuned nicely, the whole affair will be a noisy failure. Perhaps, however, I am assuming too much for the average reader, when I expect him to be able to set a musical scale successfully by his ear alone; and indeed this seems the more probable when we remember that not one out of five hundred musicians can tune an instrument at all. But in cases where the ear is thus deficient, the goblets can be tuned nicely by any keyed instrument that is itself in tune. In which case he has only to start at the tone indicated by his lowest goblet, and tune the succeeding ones in unison with those of the ascending scale of the instrument. In any event it will be found a fine discipline for the ear. Where the experimenter finds it impossible even to tune in unison, he had better direct his efforts in other channels of course. I am not writing for him.

Your tuning completed, the next operation will be to arrange your goblets to the best advantage, both for quality of tone and convenience of manipulation. To this end it is perhaps better to place your goblets on a long, inverted empty box, made of thin material, securely fastened together. Place the whole on your table, with the goblets arranged in the same order as the keys on a piano, placing the half tones, or sharps, corresponding to the black keys, slightly in the rear of the main line or diatonic scale, for the convenience of the performer—being careful that no two goblets touch each other; also that they rest firmly on the box, in order to avoid jarring. If your scale extends to two octaves, it might be well to arrange your goblets in two separate lines perhaps.

Now your instrument is ready, and you may take your mallet and play any air with which you are familiar, from a Sabbath school song to an opera. And my word for it, you will be surprised and delighted at the beauty and capacity of this little home-made instrument. The tones are very pure, limpid and mellow, and free from that metallic tendency so inseparable from all pianos. Of course much will depend upon the taste and skill of the performer, and some practice will be required to play rapid passages; but it is certainly susceptible of much variety and musical effect when properly handled. Shakes, trills, turns, runs, etc., are all within its scope, and only await the player's skill. The tone may be varied by the use of either the padded or the wooden end of the mallet, as the case may require. The glasses should be tapped on the outside, near the top. If it be desired to keep the instrument for any considerable length of time, it will be found necessary to re-tune it at intervals, as the tone changes by evaporation of the water. And if the water is left in a long time in a warm room, the tone will become deadened and spoiled. By having a mallet in each hand, two parts can be played at once, after some practice, and the harmony is very pretty. If the whole is properly constructed and well tuned, it will be found wonderfully melodious and effective.

H. Hendricks.

Kingston, N. Y.

How to Read a Drawing.

Continued from page 30.

IN the previous article we saw that neither a perspective view nor a simple plan will enable those who are not very expert to determine the exact dimensions even of such a simple object as two blocks lying one on the other.

Fig. 1 being a perspective view, and Fig. 2 a plan of two blocks, it is evident that it requires a drawing like Fig. 3* to give the precise thickness of the blocks. Such a figure is called an elevation, and these two

*The artist has, by mistake, drawn Fig. 3 with diagonal lines, as if it were a section. The shade lines should be perpendicular, like those in Fig. 6.

figures (2 and 3) are all that are necessary to enable us to reproduce the object from which they were drawn. The example that we have given is, however, probably the simplest that could have been chosen, and

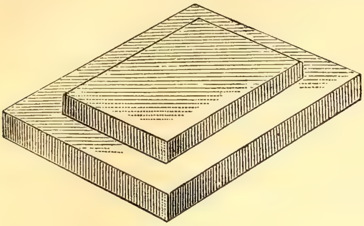


Fig. 1.

greater complication would have required a change in our method of drawing it.

Suppose that instead of two blocks lying one on the other, the object had been a block with a hole in it, such as is shown in

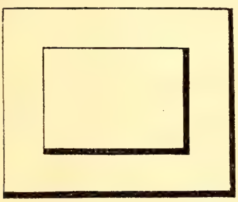


Fig. 2.

Fig. 4. A plan of Fig. 4 is given in Fig. 5, but a side elevation of Fig. 5 would be Fig. 6. This would give us the thickness of the block, and as the length and

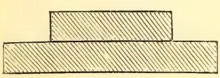


Fig. 3.

width of the hole are shown on the plan, it would be easy to reproduce the article. Instead of an elevation, however, most draughtsmen would give a section of

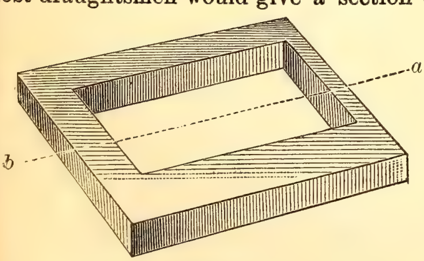


Fig. 4.

Fig. 5, as shown in Fig. 7. This shows the block as if it were cut in two along the line *a*, *b*, and the ends of the solid part of the block are seen *in section*, as it is called.

The reader will here notice that the lines on these different figures run in different

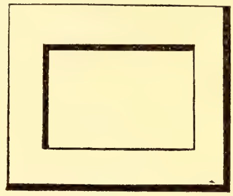


Fig. 5.

directions. The direction of each line is intended to express something. Thus, mere shading lines, like those on Figs. 1, 4 and 6, run either horizontally or perpendicularly. The lines on sections always run diagonally, making an angle of forty-five de-

Fig. 6.

grees with the perpendicular. Such a direction of the lines always indicates a section.

A section must always be carried through on a certain line. For example, as previously stated, Fig. 7 is a section on line *a*, *b*, Fig. 4. Everything through which the

Fig. 7.

line *a*, *b*, passes, is shown in section, as the reader will very clearly see. In some cases sections and elevations are combined. Thus, in Fig. 8, the parts through which the line *a*, *b*, passes, are shown in section, and the parts behind that line, and through which it does not pass, are shown in elevation.

Fig. 8.

The subject of sections is an important one, and will occupy our attention in the next article. We would again remind our readers that the object of these articles is not to teach the art of drawing, but to enable our young friends to understand drawings, and work from them.

Simple Lessons in the Art of Photography.

THE CAMERA.

THE camera obscura, or darkened chamber, is the invention of Baptista Porta, of Padua. Its principle will be easily understood by the very simple experiment of darkening a room and admitting a single pencil of light through a small hole in the window shutters. If a piece of paper is held at a little distance from this aperture, the figure of external objects will be seen delineated upon it. A lens placed in the hole will render the picture more distinct and brilliant.

A dark box may be substituted for the dark room, and the effect will be the same.

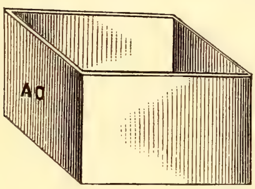


Fig. 1.

Fig. 1 represents such a box, A being the lens, and the opposite end the ground glass or oiled paper.

In the ordinary camera used for tracing the outlines on ground glass with a lead pencil, a mirror is introduced, which throws the picture upwards on the ground glass, placed horizontal, for the sake of greater convenience in drawing. Fig. 2 shows the section of a sketching camera. C is the

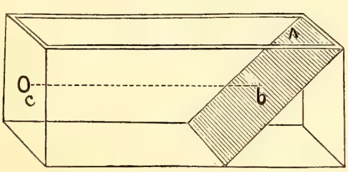


Fig. 2.

lens fastened in a sliding tube; *b* is the mirror placed accurately under an angle of forty-five degrees, or half a right angle; A is a piece of ground glass, which is removable. The focus of the lens must be equal to the distances A to *b*, and *b* to C. If, for instance, A *b* is 3 inches, and C *b* 6 inches, the focus of the lens for such a camera should be about 9 inches. The longer the focus of the lens, the larger is the picture on the ground glass. A lid may be used to exclude the light during sketching, but a piece of dark cloth one yard square will do it more effectually.

In photographic cameras the mirror is omitted, since its absorption of light would necessitate a longer exposure. Fig. 3 represents the simplest form of a photographic

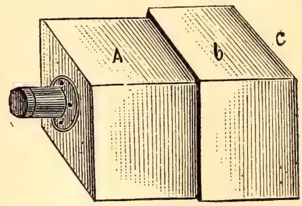


Fig. 3.

camera. It consists of an outer box, A, and an inner box, *b*; the latter slides in the former. The rear end, C, is especially adapted for the reception of the plate-holder. The plate-holder, Fig. 4, consists of a square frame, with a door on the rear

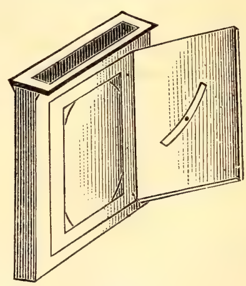


Fig. 4.

end, and a slide moving in grooves on the front side. The sensitized plate is placed on silver wires stretched across the corners of the frame, and kept in position by a spring fastened to the door. When bringing the object into focus, the front slide is removed, and a piece of ground glass is placed in the plate-holder, and the lens is moved forward and backward till a sharp picture is obtained. Cameras of better con-

struction, with bellows and focussing screw, are provided with a special frame holding the ground glass. The purchaser should always convince himself, by actual measurement, that the ground glass and the sensitized plate in the plate-holder occupy exactly the same plane. The construction of a photographic camera requires great skill and numerous tools, and therefore it might be advisable for the amateur to buy a ready made camera, with plate-holder.

Of simple lenses the plano-convex lens, with plane side towards the object, gives, after the meniscus with the concave side to the object, the most correct image. For landscape photography, simple lenses will do very well, lenses of larger diameter being preferable to those of a short diameter. For portraiture a combination lens, or portrait lens, is indispensable, though good results may also be obtained with a simple lens of large diameter.

The use of a simple lens always necessitates a small diaphragm or stop, in order to counteract spherical aberration and the want of achromaticity. Stops can easily be made of pasteboard to fit exactly into the tube of the lens. Fig. 5 represents a diaphragm. The projections, *a*, *b*, facilitate removing the stop. The centre of the diaphragm must coincide with the centre of

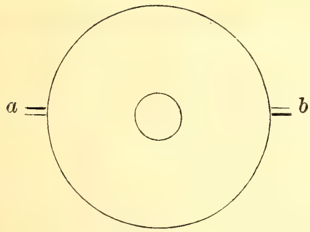


Fig. 5.

the lens. The position of the diaphragm, either in front or behind the lens, is immaterial, though a slight difference is thereby produced. Small diaphragms, that is, diaphragms with a small aperture (1-4 to 1-12 inch), increase considerably the depth of the focus, near and distant objects will be in focus at the same time, and the picture on the ground glass will be everywhere equally sharp. The disadvantage of a very small opening in the diaphragm lies in the fact that it diminishes the illumination of the image on the ground glass, and thereby renders a longer exposure necessary.

In order to ascertain whether the actinic and visual foci in a lens coincide, a thin piece of violet colored glass is placed before the lens, and the object is focussed on the ground glass. The violet colored glass is now removed, and if the image still appears sharp, the actinic and visual foci coincide. The visual focus is that distance between the lens and the ground glass which produces on the latter a sharp picture visible to the eye. A picture in the actinic focus may not appear sharp to the eye, and yet the picture will require a shorter exposure, and the negative may exhibit the most distinct outlines. The violet colored glass can just as conveniently be fixed permanently in the tube in front of the lens. For focusing, a piece of black velvet, or some other material impenetrable to light, about one yard square, is usually employed.

For copying pictures, the camera can be placed on a common table; for landscape photography and portraiture we need a tripod, which is easily constructed. A piece

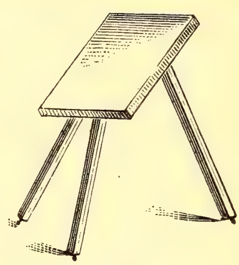


Fig. 6.

of oblong board, a little larger than the camera, is provided with three good hinges, one hinge in front, and one on each side, as shown in Fig. 6. Each hinge is fastened to a narrow slat of wood, which serves as leg. On the top of the oblong board you may nail some strips of wood, at such a distance apart that the camera can be tightly squeezed into them.

THE

YOUNG SCIENTIST.

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The Trial Trip.

WITH this issue the trial trip of many of our subscribers comes to an end, and of course we shall assume that those who fail to remit do not want the journal. To those who desire to continue with us, we would say that on receipt of the balance of the year's subscription—35 cents—their names will be entered for the year 1878.

We believe that we have kept the journal up to the standard of our promises, both as to matter and as to illustrations. Although we distinctly stated that we did not intend to make the YOUNG SCIENTIST a mere picture book, it has contained as fine illustrations as any journal of its class, and some that are far finer and more valuable than those which have appeared during the same period in much more pretentious and expensive periodicals. These illustrations have not been old electrotypes, purchased for a trifle, but new wood-cuts prepared expressly for our columns.

Of late we have had so much valuable matter on hand, that we have given four extra pages each month. Our readers will please remember that we do not promise this all the time.

The writers of almost all the letters that we receive say, "If you can keep your journal up to the standard of the number that I have seen, I will be a constant subscriber." In reply we would only ask our readers to examine our record. No. 2 was certainly an improvement on No. 1; No. 3 was better than No. 2; the present issue is equal to any that has gone before it, and we have in preparation material that will make the journal better and better as it grows older. But to make the journal all that we would like it to be, we must have a large subscription list—at least thirty thousand—and we hope our young friends will use their best efforts to bring this about. Let each one remember that every additional subscription enables us to give a better journal to those who have already subscribed.

That our success, thus far, is all that we could have desired, is evident from the fact that, although but four months old, we already have a larger circulation than any other scientific or mechanical journal published in this city with the exception of the *Scientific American* and the *Popular Science Monthly*.

The Right to Make Patented Articles.

TO those who comply with its provisions, the patent law of the United States secures the exclusive right to MAKE, USE and VEND any invention to which they can properly lay claim. And no person, not legally authorized so to do, can perform any one of these acts without laying himself liable to an action at law. Great doubt and confusion of ideas seem to exist upon this subject in the minds of many of our amateur mechanics and scientists, and even one of our mechanical monthlies, which makes great pretensions to being an authority upon *all* subjects, actually told its readers some time ago that any one had a right to make a patented article *for his own use!* It is unnecessary to say that this was an error, but

as in these days, when amateurs are making telephones, telegraphs, engines, etc., for their own use and for experiment, it may be well to tell our readers clearly and distinctly just how far they may go in this direction.*

The real state of the case, then, is that, according to the strict letter of the law, no person not authorized by the patentee or his representative, has any right to make a patented article for any purpose whatever. Those who make such articles are liable to be enjoined by the courts from further making or using them, if the patent has been properly sustained, and they are also liable to an action for damages. But unless actual damage has been inflicted upon the owner of the patent, it is very unlikely that *any* legal action would be taken, for if the patentee did take legal action, it would involve him in great trouble and expense, without any return whatever. This applies to cases where the advantages derived from the use of the invention are of a mere intellectual kind, but when the invention has been put in practice to the pecuniary profit of the infringer, damages may be collected, and a suit would probably be instituted.

Let us take the case of the telephone, for example. If some commercial or manufacturing house were to construct one or more pairs of telephones for the purpose of communicating between different parts of their establishment, they would be liable to an action for damages, because they would be deriving a substantial benefit from the use of the invention. But if some amateur were to construct a telephone for his own amusement, and for the purpose of studying the phenomena of magneto-electricity and sound, no damage would be done to the patentee, and as no court would award damages, it is not likely that the patentee would be so foolish as to institute a suit. If, however, these amateur telephones were used for purposes of public exhibition, the inventor would sustain damage, and would very likely bring a suit, since telephone exhibitions are an actual source of profit to the manufacturers.

It has been alleged that the use of an invention for scientific purposes is not an infringement in the legal sense, but this depends entirely upon circumstances. The whole question turns upon the amount of pecuniary advantage derived by the infringer, and the loss sustained by the patentee. We believe that even the use of an unlicensed telephone by a college professor, for purposes of public instruction, would lay him liable to an action; and since in this case the instrument is employed for pecuniary profit, its use is morally wrong, being in violation of the spirit of the contract existing between the public and the inventor.

Our readers will readily see then that whenever they construct any patented article, and apply it to any purpose which is to their pecuniary advantage, they commit a wrong legally and morally. But when the instrument is made and used wholly for intellectual purposes, and in such a way as not to work injury to the inventor, they are perfectly safe.

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*In giving the advice which follows, we have considered not only the legal rights of the patentee, but the equitable rights of the public. Every patent is a bargain between the public and the inventor, in which the former agrees to give the latter all the profits arising from the invention during a certain period, provided the inventor will give the public the full benefit of all the knowledge and skill which he possesses in relation to the particular invention on hand. The fact that patents are always issued to the first inventor, and that there is scarcely any invention that has not been brought out at nearly the same time by several inventors, one of whom gets all the benefit to the exclusion of the others, constitutes every patent a species of robbery of all those who have the ability to devise for themselves, but who have not brought their inventions before the public. This partial evil and injustice must, however, be submitted to by the few for the good of the many. *Exclusive* property in any invention is therefore a legal and not a moral right. No man has a moral right to prevent me from using my brains in making any invention to which I am competent. It is only those who deal in buncombe who assert that any man has, on moral grounds, any *exclusive* right to his invention. The only rights that any inventor can have, if we exclude those which he obtains by law in virtue of his bargain with the public, is to practice his invention in security, and keep it secret as long as he can. But the people, having, through their representatives, agreed to give the patentee the benefits to be derived from the exclusive use of the invention during a certain period, are morally, as well as legally, bound to hold to this contract.

Miss Heller's Second Sight.

THE feats of an expert prestidigitateur have a charm for all ages. The young enjoy them in wonder and amazement; to those of riper years the methods by which the various feats are performed constitute a most interesting study; and the old enjoy them because they are made to feel young again. No wonder, therefore, that the exhibitions of first-class performers, like Heller, are crowded every night with a delighted audience.

The so-called magician has in all ages employed extensively the resources of natural science, and to-day the *seance* of any one who is more than a mere juggler, is a veritable exhibition of scientific wonders. Science alone, however, will not enable any one to become an expert, any more than a mere knowledge of the laws of electricity will enable one to become a good telegraph operator. All Heller's apparatus and all his knowledge might be placed at the disposal of his audience, and out of that crowd there is probably not one that would make even a tolerable performer. Great natural skill and long training have given Heller an ease of manipulation and a certainty of success which never fails to astonish, and when to this we add the attractions of geniality and *bonhomie*, it is no wonder that people crowd night after night to hear him.

Mr. Heller makes great use of electricity and electro-magnetism, and most of his feats are ingeniously conceived and very deftly performed. His windmill and miller are admirable pieces of mechanism, though we must acknowledge that this mechanism is almost too apparent. His pistol feat is good, but old; we have seen a much better and more astonishing method of performing the same trick. The transfer of the handkerchief to the heart of an orange which has developed on a tree in full sight of the audience is also very pretty, though perhaps a little too obvious.

To describe these and other wonders would, however, occupy too much time, and therefore we proceed at once to a consideration of the famous second sight, which has been for weeks the acknowledged attraction of his exhibitions. Now that Mr. Heller has withdrawn this feature from his performances, we will endeavor to explain how it *might* be done. There are several ways by which the same result might be attained; we will merely give that which seems to us best adapted to the end in view, and although it may not be the precise means used by Mr. Heller, it is certain that it is competent to perform all the wonders of the so-called second sight. Second sight, as exhibited by Miss Heller, has been frequently described in the papers. We will therefore give merely such a brief description as is necessary to an understanding of our explanation.

Miss Heller appears on the stage, and, after being blindfolded, seats herself on a lounge or sofa. Mr. Heller then walks amongst the audience, pointing to various articles, or touching them, and the lady at once, on the question being asked, not only tells what they are, but describes them. Thus, in the case of a fan, she not only tells us what the article is, but she further tells us that it is black, and that it has a tassel. A stick is described not only as a cane, but as brown and with a white top. Still more wonderful, one gentleman produces a watch, and she not only tells what it is, and what it is made of, but reads the time, details the figures engraved on the case, and even reads the motto—SINE TIMOR. Another gentleman produces a *shinplaster*, as it is called—one of those issued in an inland city—Rochester, N.Y.—in the early days of the late war. She gives the number, the value, the location, every required particular; and with peculiarly feminine *naiveté* she simulates an ignorance of the precise character of the articles, and of those features concerning which ladies are not supposed to be in general thoroughly informed. The little paper token she calls a thing like a bill, and articles of masculine property are described in the same vague way—all of which adds to the charm of the performance.

Several ways have been devised for car-

rying out this performance. Many years ago, Dr. Paris, in his well-known book, "Philosophy in Sport made Science in Earnest," detailed one of the best, but we are satisfied that the method described by Dr. Paris is not calcutated to give the exceedingly prompt and accurate results attained by Miss Heller. It is possible that several systems are used each evening, but there is one which is easily put in operation, and which is equal to all demands. This is the electric telegraph, and when we remember the extensive use made of electricity by Mr. Heller, we feel that it is more than probable that this is the agent employed. His miller, who opens and shuts the door of his mill, and throws out the cards, is electricity; the tree buds and the oranges are developed by electricity; the gun-cotton, which simulates the handkerchief that is supposed to be burned, is ignited by electricity; the half-dollars are dropped on to the glass stairs by electricity, and by the same agency they are allowed to fall into the body of the cash-box from a compartment in the side or top; the dropping of the curtains, and the firing of the gun-cotton in the medium scene, are also done by electricity. It is more than probable, therefore, that electricity is the chief agent in Miss Heller's second sight. But how is it applied? Mr. Heller carries no telegraph in his hand; he is perfectly free in all his movements; no wires seem to be connected with him in any way; how can it be done?

Nothing more simple. Proceeding from the stage might be two wires which pass underneath the carpets in the aisles to all parts of the house. These wires are connected with the tacks which hold down the carpets, and in this case these tacks do actually have large bright heads. Wire No. 1 being connected with one pole, and wire No. 2 with the other, each alternate tack is connected with a different wire. If, therefore, any two adjoining tacks be connected, the circuit will be complete.

To make use of this arrangement, the operator might have shoes or slippers with soles of wire gauze, or very thickly sewed with wire, or pegged with fine metal nails, and to these soles might be connected a wire which would pass up one leg of his trousers and down the other. Therefore, whenever the operator stood so that his feet rested on the heads of two consecutive tacks, the circuit would be complete. A small circuit breaker could of course be easily placed in one shoe, so as to be operated by the toes, and in this way telegraphic communication could be established with the stage, or the circuit breaker might be carried on some other part of the person. The receiving instrument on the stage might be merely a vibrating armature, the movement of which would be felt by the foot of the person on the stage, and several of these might be placed on different parts of the stage, so as to allow a considerable range of movement to the person who acts as seer.

Several circumstances conspire to convince us that this is the real solution of a problem which seems to have puzzled all our journalists. On several occasions, where Miss Heller has hesitated or made a mistake, the mistake has been just such as a telegraph operator would make in misinterpreting phonetic signals, such as "oysters" for "Austria." Moreover the answers often come too promptly to be explained on the system of verbal signals. It is probable that the required information is sent *before* the question is asked, and this renders the employment of the telegraph probable.

Taken all in all, it is one of the most ingeniously carried out arrangements that we have met in a long time. And like every part of Mr. Heller's performance, it is done with a dexterity and skill which renders it a pleasure even after we are fully apprised of the means employed.

— Education does not come through academies and colleges; these are helps, but it comes by study and reading and comparing. All the colleges in the world will not make a scholar of a man without these; and with them a man will be one if he never sees a college. It is that indomitable "I can" that sets a man astride the world.

Microscopy.

The Development of Frog Spawn.

IN a recent number of *Science Gossip*, Mr. A. M. McAldowie publishes the following notes on the development of frog spawn. A small quantity of this material, which will soon be abundant in almost every locality, forms a very interesting subject for observation under a low power. The following are the notes referred to:

"About the end of March, 1874 (exact date uncertain), I exposed a mass of frog's spawn to the light in a glass tank, placing it in a window having a westerly aspect. There was no fire in the room. The small round ovum (Fig. 1) gradually became elongated, assuming at first an ovoid form, but afterwards one end became attenuated, while a small groove formed near the other extremity, and on the 4th of April most of them presented the appearance shown in Fig. 2. As the embryo enlarged, these characters became more marked, until, on the 8th, the form of the head and the body could plainly be detected (Fig. 3).

"April 8th. Most of the embryos show signs of animation. The movements consist of alternate flexion and extension of the body, the animal folding itself up laterally and then straightening itself at intervals of about half a minute. Movements first observed in the afternoon, and continued till sunset.

"April 9th. Movements more active than yesterday, but still as restricted as before.

"April 10th. Movements not quite so quick as yesterday, but more extensive and fish-like.

"April 11th. Most of the tadpoles appear to be trying to free themselves from the albuminous mass by quick wriggling movements. External gills very plainly seen on all (Fig. 4). They first appeared as two small protuberances, situated one on each side of the hinder part of the head. These gradually elongated, divided and subdivided, until they presented the appearance of small branched filaments.

"April 12th. Tadpoles all out this morning. Arrange themselves in clusters with their heads all in one direction. Most of them remain quite motionless, but a few swim actively about the tank."

Fig. 1. Nat. size, March. Fig. 2. Ditto, April 4th.

Fig. 3. Ditto, April 8th. Fig. 4. Ditto, April 11th.

FROG'S SPAWN.

It will be observed that the figures are in pairs; in each case the left hand figure of a pair shows the dorsal aspect, and the right hand figure the lateral aspect.

Simple Hints for Beginners.

NO. I.

WE propose to give, from time to time, such simple elementary instructions in regard to the use of the microscope as will smooth the path of those who are commencing the study, and whose instruments are not of the best quality. It is all very well to say "don't buy a poor microscope;" suppose the reader has one of this kind already, and cannot afford to buy a better one—is it not better to work with a poor instrument than not to work at all? By keeping carefully within the bounds of what such an instrument can accomplish, it is wonderful how much it will show us.

One of the first things to be learned is the art of getting the object well illuminated. We must remember that the microscope is, after all, only an addition to the eye, and as the eye sees only by means of light, unless plenty of light passes from the object to the eye, we cannot see it. At the same time, we must avoid a mistake of exactly the opposite kind, and avoid getting too much light. The difficulty of reading letters which are written or engraved on bright metal strongly illuminated, shows the necessity for properly adjusting the amount of light to the circumstances of the case. As a general rule, the higher the magnifying power used, the greater is the amount of light required. With low powers—twenty to fifty diameters—even the cheapest compound microscopes will work with very moderate light.

The necessity for proper illumination is felt more in using the simple microscope than in any other. With very low powers, it is true, it is not difficult to see almost anything, but when the focal length of the lens is less than half an inch, it requires some care to prevent the frame of the glass or some part of the person, from shading the object, and in that case it will be impossible to see clearly. If the reader will carefully watch either his own movements, or that of a friend who is examining some opaque object with a simple microscope, he will soon see how want of care and skill in this respect prevents complete success. When the difficulty is once pointed out, however, it is easy to avoid it, and then we will be astonished at the wonderful improvement that our lens has undergone.

By means of good illumination, it is easy to see, with a power of ten diameters, things, which, with slightly inferior illumination, are quite invisible with a power of twenty-five. Indeed, good illumination will often supersede the necessity for a magnifier, and dissections and similar operations may be carried on better with the naked eye than with a lens. To prove this it is only necessary for the beginner to examine such objects as eels in vinegar or in paste. Place a drop on a slide, and look at it, without special illumination, holding it so that the ground or any dark surface may form the background. No eels will be seen. Now hold the slide against the light, and somewhat obliquely, and the eels will be quite distinct.

In the above case the objects are transparent, that is to say, we look *through* them, but the principle applies equally to opaque objects, or objects which we look *at*. Suppose we have a few portulacca seeds, one of the most beautiful objects that can be found. If we look at them through a cheap compound microscope—having merely laid them on a dark ground—they will be almost invisible. But if we throw on them a strong light, by means of a condensing lens, they will show with great beauty, even with a cheap non-achromatic microscope.

To be continued.

Trichina.

FROM several parts of the country there come to us reports of sickness and death, caused by the presence of these parasites. A gentleman who has been investigating the subject carefully, reports a very large percentage of the ham and pork in the New York market as being infected with trichina. Trichina are easily detected by means of a microscope of low power. The

cysts or capsules in which the "worms" are lodged may readily be detected with the naked eye, and a power of twenty diameters shows the worms themselves very plainly. The only way to avoid these creatures is to thoroughly cook any meat that may be eaten—especially pork or ham. Trichina are, however, sometimes found in beef, the cattle having been fed on grass manured with matter from slaughter-houses, and the pig pens attached thereto. In these slaughter-houses the rat is the greatest distributor of trichina. Rats are almost sure to get trichina from some of the flesh that they eat; while sick and feeble from the effects of this diet, they are apt to be caught by the pigs, in whom the trichina then multiply enormously. The extent to which rats and mice are infected with trichina leads to the further fact that most cats are so infected. We have in our possession several preparations made from different parts of the cat, and the muscles are all infected with trichina.

Laboratory & Workshop

How to Solder.

There are two ways in which this operation may be performed; one is by using the ordinary soldering iron; in the other the heat is obtained from a lamp. The first is the most workmanlike, and gives the best results, but the latter is most easily learned, and as any of our readers can easily manage to join pieces of brass, copper, tin plate, iron, etc., in this way, we will describe it first.

In soldering, the essential conditions are that the surfaces to be united shall be clean, and that they shall readily unite with the metal used for solder. All surfaces should therefore be scraped bright with an old knife, a file, a scraper, or even emery paper, but as they will not *stay* bright when heated, we must use something which will keep them so. For copper, brass or tin plate, resin is very good, but for other metals a solution of zinc in hydrochloric acid is best. Fill a small phial half full of dilute hydrochloric acid, put into it as much zinc as it will dissolve, and you have the soldering fluid, or liquid solder, which is now so much advertised, and which is sold on the sidewalks in New York.

The ease with which the different metals may be soldered is in order as follows: Tin plate, copper, platinum, silver, brass, wrought iron, steel, cast iron. We have heard some tinsmiths say that cast iron cannot be soldered, but this is a mistake; we have done it often.

The bright metal generally used for solder is an alloy of tin and lead—two parts of the former to one of the latter. A more fusible solder is sold in small strips at the hardware stores. A little bit of solder may, however, be obtained from any tinsmith, and will serve every purpose. Where solder cannot be had conveniently, tin foil, such as comes round tobacco, answers well. We have done a great deal of work with it. This tin foil is not pure tin, but consists of a sheet of lead between two sheets of tin, the compound sheet being rolled out thin.

For a lamp, anything will do. We have used candles and kerosene lamps, but greatly prefer a spirit lamp, as it is free from smoke and grease. An old ink bottle (one of the little triangular ones), with a hole through the cork, and through the hole a tube for the wick, does well.

Having procured the materials, let us now proceed to work. Suppose the job is to fasten a wire to a tin can for a battery. Scrape the end of the wire bright, and also scrape the tin; lay some solder on the latter; touch with a drop of soldering liquid, and heat over the lamp till the solder melts. The heat should be applied only to the spot where the solder rests. Dip the end of the wire in the soldering liquid, and as soon as the solder melts place the wire where it is to go, and hold it there till the solder has flowed all round it. Remove it from the flame and allow it to cool. It will be very firmly fastened.

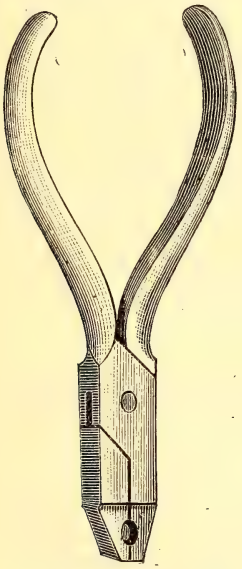
Suppose we wish to join two wires together. Hammer the ends flat, file them bright, lay them together, and bind firmly with fine iron, brass, or copper wire. Moisten with soldering liquid, lay a piece of solder on the joint, and heat in the lamp. When cold the joint will be very strong. By making a long splice, and filing off the binding wire after the solder has cooled, a joint may be made which will be scarcely perceptible, and yet be very strong.

Always, after using soldering fluid, wash off the joint carefully with pure water.

A very little experience will enable any one to join almost any two pieces of metal, and to solder a patch upon a metallic vessel.

Entomologist's Pliers.

Some time ago a friend showed us a very handsome pair of forceps, which had been made for the purpose of taking insects out of their cabinets and replacing them. In most cases insects are preserved by being impaled on slender pins, with heads like ordinary pins, and in order to examine any particular insect, it is necessary to pull the pin out of the cork lining of the cabinet. In doing this with the fingers alone, one is very apt to injure the insects on the adjoining pins, and therefore our friend had procured the forceps just mentioned. Such forceps, however, were open to two objections; they did not grasp firmly the



ENTOMOLOGICAL PLIERS.

round head of the pin, and the legs being levers of the wrong kind, the power applied was greatly wasted.

By taking a pair of common steel pliers, and softening the nose in the fire, a hollow may be filed in each blade, as shown in the engraving. This hollow receives the head of the pin, while the part just below the head is grasped with great firmness by a very slight exertion of power. By means of pliers fixed in this way, insects mounted on pins may be very readily taken out of their cabinets and replaced. The pliers may be rehardened if desired, and are then as good as ever for the purposes for which they were originally intended.

Tempering Small Steel Tools.

The art of tempering small tools is by no means difficult to acquire, and when we have learned to do it well, we can often save a great deal of time and trouble, by doing it ourselves, instead of having to go to a distance.

There are two distinct operations in the process of tempering. We must first *harden* the tool, and then let it down, as it is called, or soften it so that it will no longer be brittle, the rule being that a tool should be as soft as possible, provided it will keep its edge. Thus tools intended for cutting wood are always much softer than those used for cutting metal.

To temper a tool proceed as follows: Heat it to a bright red, and plunge the part to be hardened into water. We hear a great deal about *secrets* in the art of hardening, but they amount to very little. Some add salt, arsenic and other things to the water in which they harden steel, and claim to get much better results by so doing. The truth is that well boiled water is as good as any ordinary material. Fresh water has so much air in it that it will not harden steel well, because the air forms a thin coating on the steel, and prevents contact with the water, and the steel is a long time in cooling. Hence we find that blacksmiths like *old* water, that has been used a long time, for hardening. The reason is that the air has been all expelled, and if a little oil has been dropped in the tank, it will have kept the air out by covering the entire surface with a thin film. Small tools are sometimes hardened in mercury, and can be made very hard in this way. Small drills are often hardened by being heated in the flame of a candle, and then cooled by being thrust into the tallow. This answers well, but is no better than water. The mechanical journals often contain what is said to be a very valuable recipe for tempering, which is to plunge the heated tool into sealing-wax. This answers well, but has no special advantages. Very small tools and thin plates may be hardened by waving them rapidly in the air, and

it is said that some famous sword blades are tempered in this way.

No special skill is required for hardening small tools, but thin plates and large pieces require great care or they will crack or warp. They should therefore be handed over to some one of experience. Having hardened the tool, the next step is to *temper* it, since if left hard it would be brittle. It must therefore be heated until it has been sufficiently softened, and this varies with the use to which the tool is to be put. For drilling or cutting very hard substances, the temper should be high; soft substances may be cut with tools that are not so hard.

The degree of softness is judged by the color which the steel assumes when heated. A piece of hard steel, which has been made bright on a stone, becomes, during the process of heating, first straw color, then brownish yellow, then light purple, then dark purple, and lastly blue. The straw color, in its various shades, answers for tools intended to cut metal; tools for cutting wood should be brought to a brownish yellow; tools that are to be struck with a hammer should be made a little softer than those that act by pressure.

The temper of the cutting part may be let down in several ways, but the easiest and best is to cool or harden only the end of the tool, and leave the rest hot. In a few moments the heat will have been conducted from the hot part to the hardened part, and when the latter has assumed the proper color, the whole of the tool is cooled, and the tempering is complete.

Our Ten-Cent Battery.

The numerous letters that we have received, asking for further information in regard to this little piece of apparatus is evidence to us of the deep interest which many of our readers take in the subject, and we therefore answer in a general way the inquiries received.

The battery is simply a Daniel's battery, in which the tin can plays the part of both jar and copper sheet; the paper cup serves as a porous cell, and the zinc remains as in all batteries. The use of the wooden block in making the porous cell is simply to serve the purpose of a mould. If such a cylinder is not at hand, the paper may be rolled upon itself into a tube, three or four thicknesses of paper being used, and this tube being placed upright on a smooth surface (a board, for example), liquid plaster may be poured into it to a depth of half an inch, and allowed to set. And, by the way, let us say that the plaster is never used by dealers to fasten *chimneys* on lamps, as was inadvertently stated in our last, but to fasten the brass necks to the bowls. The object of the plaster is to form a heavy bottom to the paper cell. The wood is, of course, removed as soon as the cell is finished—that is, as soon as the plaster has become hard.

It is, of course, always better to amalgamate the zinc, especially if a durable battery is wanted, but very good results may be obtained without amalgamation. To amalgamate a new zinc, rub it with mercury and dilute sulphuric acid until it is as bright as a new dollar. When zinc, well amalgamated, is used with earthen cells and glass jars, the best liquid to use next the zinc is dilute sulphuric acid, but with unamalgamated zinc, paper cells and a tin can, it is best to use a strong solution of sulphate of soda, rendered very slightly acid.

The liquids must not be left in the battery until after the tin can has become heavily coated with copper.

Do not let the paper become dry, except after it has been washed out in clean water.

This battery is not a mere creature of the imagination. Some years ago we put together a considerable series, constructed substantially as we have described, and we obtained very satisfactory results.

Correspondence.

Iron Shot.

Ed. Young Scientist—In your article on iron bird shot, in the January number of your valuable journal, you say that, owing to the lightness of iron, shot made of that metal would reduce the range of a gun nearly one-half. It is evident that if the shot are made of such a size as to be of the same weight as leaden ones, the only loss of force would be that due to a slight increase of resistance of the air, owing to their greater size. Let us see how much this difference would be. As the specific gravity of lead is 11.25, and that of iron is 7.78, and as spheres are to each other as the cubes of their

diameters, knowing the diameter of a leaden shot, we can compute that of an iron one of the same weight.

Let us call the diameter of the leaden one 10: then the cube of $10 \times 11.25 \div 7.78 = 1446$; the cube root of 1446 is not quite 11.4, the diameter of an iron shot that would have the same weight as a leaden one whose diameter is 10. Now as circles are to each other as the squares of their diameters, the resistance of the air on an iron shot would be not quite 130, to 100 for the leaden one.

Now call the distance which a leaden shot will travel 10, then $10 \times 100 = 1000$, the total resistance necessary to stop either shot; $1000 \div 130 = 8$ nearly, so we see that an iron shot of the same weight would lack only one-fifth, instead of nearly half the range of a leaden one. This would be correct if nothing but the resistance of the air would tend to stop the shot; but as gravity would tend equally to bring both down, this would act to make both somewhat nearer equal. Now if, as is hoped, the iron shot would, by reason of not being flattened by crowding in the gun, scatter less, the effective range might be greater than with the leaden ones. Then there is the advantage of their not being poisonous to be taken into account. Birds have been killed by picking up shot, and a number of people were recently very seriously poisoned by lead absorbed by vegetables; cows are also said to have died from the same cause. H. A. Sprague.

Charlotte, Me.

Are Snakes Beneficial?

Ed. Young Scientist—I was much pleased to see that you have a good word for the toad, but as your article would seem to indicate that toads destroy mice as well as insects—which, if true, is new to me—I would ask if you meant to be so understood? You also say that we should cultivate the friendship of insectivorous reptiles—including the snake.

Now I would like to inquire if there is an insectivorous snake that does not also eat the toad? I and many others have seen snakes in the act of swallowing the toad. It is evident that snakes of this class ought to be destroyed, but there may be a purely insectivorous snake. If there is will you please describe it, so we shall know it from the harmful kinds.

H. A. Sprague.

BOOK NOTICES.

The Boy Engineers: What They Did and How They Did it. A Book for Boys. By the Rev. J. Luken, author of "The Young Mechanic," "Amongst Machines," etc. New York: G. P. Putnam's Sons.

The term "engineer," as used in this book, will, we are afraid, convey somewhat erroneous ideas to our American boys. The construction of engines and machines is certainly "engineering" in the strict sense of the word, but we are not accustomed to associate this term with the construction of wooden clocks and organs, or with the art of carving. Be this as it may, however, the book is a capital one. It details in simple language the work of two boys in making lathes, clocks, automata, engines, organs, apparatus, etc. It tells of their difficulties, and the means by which they surmounted them, and gives a great many very valuable hints and suggestions. Our readers, old or young, who may procure this book, have a rich treat in store for them.

United States Official Postal Guide: April, 1878. Price 50 cents. Boston: Houghton, Osgood & Co.

This valuable publication is published in pursuance of an express law to that effect, and with the authority and co-operation of the Post-Office Department at Washington. It contains an alphabetical list of post offices in the United States, with county, State and salary; money order offices, domestic and international; chief regulations of the Post-Office Department; instructions to the public; foreign and domestic postage tables; schedules of the arrival and closing of mails at the principal cities, arrival and departure of foreign mail steamers, with other information. It is absolutely indispensable to every man whose business involves the use of the mails.

A Lady Editor.—A mechanical journal is probably the last amongst the numerous periodicals now published that we would expect to find edited by a lady, and yet "The Mechanic," published at Smithville, N. J., is one of the most judiciously conducted journals of its class, and does great credit to the editor, Mrs. Smith. The terms are $1.00 per year.

A Call to the Telephone.—Several devices have been suggested for calling attention to the telephone, when it is desired to open conversation. Most of them are clumsy, and some require the attachment of a galvanic battery. One of the simplest is described and figured in "Nature." It is the invention of W. C. Rontgen, and consists principally of a tuning fork (Ut 4), one of whose prongs is brought close to one of the poles of the magnet in the telephone—preferably to the pole farthest from

the telephone disk, a straight or "bar" magnet being usually the kind used in the instrument. The tuning fork is mounted on a sounding board. Similar apparatus is provided at both ends of the line. To sound the alarm, in order to give a call of the telephone, it is only necessary to draw a fiddle-bow across one of the tuning forks; the other, at the further end of the line, responds with a note loud enough to attract attention throughout a large room.

Inquiries and Answers.

Inquiries.

10. Can any of your readers tell me how to make something to attach to my gas burner, so that I can light my gas with a battery. G. F. P.

11. As I was reading the last number of your valuable magazine, I came across an article on camphor barometers; and being desirous of making one, and not knowing the exact composition or proportions, I would respectfully ask you to inform me in your next number. G. Y.

12. If lead should be used for filling teeth, would it poison the gums? R. S.

13. Will you please inform me what acid will eat the vegetable matter from a green leaf, and leave the animal substance, making a skeleton leaf. J. F. M.

14. If you could tell me how to make a friction polish for turned work, to be applied in the lathe, such as we see on the wood on sale in the shops, I would be greatly obliged. The beeswax, alcohol, sandarac and turpentine formula, given in all the books, will not work with me at all. H. H.

15. Can any of the readers of the Young Scientist tell me how to mount objects for use with the Craig microscope. M. T. F.

16. What are Italian images and dolls made of? Also, how can artificial maple sugar be manufactured? +

Answers.

17. I do not know that my experience will be of any use to "Traddles," but it is rather interesting both as to how to keep tadpoles, and how not to keep them. Several years ago I had charge of an aquarium containing young tadpoles and several of our common fresh water fish—I have forgotten what kinds. The fish and the tadpoles agreed very well together. The tadpoles flourished, with no special attention, increased in size, and after due time developed their legs, and would no doubt have become good honest frogs—but then the fish eat them up. This was a phase of evolution that I had not before heard of. Carl Reddots.

18. In answer to "Amateur's" inquiry how to preserve lizards, frogs, etc., I beg to inform him that by using the "preserving fluid for scientific purposes," he can keep his specimens in their perfectly natural state, without any previous preparations. See advertisement.
Hermann Hurtzig, P. O. Box 4920, New York.

19. Some tadpoles seem to live largely or wholly on vegetable matter, chiefly the green matter that grows on the sides of aquaria exposed to the light. I have seen them *mow* this green growth off in circular sweeps, as if done with a miniature scythe. The tadpoles of some species of frogs feed on dead animal matter. Try them with a few pieces of meat. It is a curious fact that tadpoles kept in the dark do not develop into frogs. I have kept them in a dark cellar for two years, and they were still tadpoles; brought to the light they became frogs. Rana.

20. "Amateur" (letter 5) will find very complete directions for preparing and preserving material for dissection and microscopical examination in Rutherford's "Outlines of Practical Histology," pages 3–7. For mere preservation, Rutherford recommends proof spirit—our ordinary alcohol will do. Where the tissues are to be hardened, they are first soaked in a ¼ per cent solution of chromic acid—that is, one grain of chromic acid dissolved in 400 grains of water. Some portions of the animal are soaked in solution of common salt. The chapter is well worth the attention of "Amateur." Rana.

21. "H. W.," (letter 6) does not state the special object for which he wishes the cement. If he wishes to fix a flat piece of brass on glass or *vice versa*, good marine glue is the best thing he can get. If he wishes to fix a brass cap on a glass flask or tube, good red sealing-wax will do very well. The proper cement for the latter purpose is the so-called electrical cement. P. J.

EXCHANGES.

In this column yearly subscribers who may wish to *exchange* tools, apparatus, books, or the products of their skill, can state what they have to offer and what they want, *without charge*. Buying and selling must, of course, be carried on in the advertising columns.

Wanted, a xylophone in good condition; a Centennial jig saw, bought in December, in exchange. C. B. Culver, 131 East Seventeenth St., New York.

Wonderful magic tricks, to exchange for books, etc. Leonard Alexander, Linneus, Me.

Back numbers of the "Youth's Companion," for the years 1876 and 1877, cost $1.75 a year; lathe, for Centennial bracket saw; or "The Speaker's Garland," Vol. 2 or 3. F. R. Miller, 750 East Fourth street, South Boston, Mass.

Scroll saw wanted in exchange for handsome portfolio of six water color sketches. Address F. S., care Box 4875, New York.

Two Selden's patent printing telegraph instruments; will exchange for microscope or books. Address W. Chamberlain, 446 Broome street, New York.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. H. A. Cutting, State Geologist, Lunenburgh, Essex County, Vt.

Thorough and practical instruction in shorthand will be given in exchange for a microscope, with or without accessories, worth from $5 to $10. Address T. P. Wendover, 68 Christopher street, New York.

Wanted, a small turning lathe, about 1½ inch swing, and 12-inch bed; must be well made; books and apparatus in exchange. R. M., care of this journal.

Wanted, a copy of Holtzapfel's "Mechanical Manipulation." State what is wanted in exchange. E. W., Box 4875, New York.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A Popular Record of Scientific Experiments, Inventions and Progress

VOL. I. NEW YORK, MAY, 1878. No. 5.

The Champion Kite, and How it was Made.

BY JOSHUA ROSE, M. E.

ISN'T she a beauty?" said one.

"Dont duck a bit," said another.

"I know why she stands so still in the air," chimed in a third; "it's because the string don't belly."

"It don't stand *quite* still," remarked a fourth. "It moves slowly sometimes."

"Yes; but she don't keep wagging her head first to one side, and then to the other, as though she was playing bo-peep with her tail," was the rejoinder.

Harry Burt felt very proud to hear these remarks applied to his new kite, and showed his gratification by letting, first one and then another of his schoolmates, hold the string.

"Hurrah! Hurrah!! Hurrah!!!" rang out upon the air as the kite became invisible.

"Out of sight, by Jove!" cried one.

"She can't have broke loose," said another, half afraid that the kite *had* done so; "because the string is tight, and she is tugging away still."

"Run it down a little and see," said Harry. And away scampered one of the boys, with the thread of the kite passing through his hand, causing the kite to lower until it was again in sight.

"Let go," cried Harry, and the boy did so. Up shot the kite as straight as a dart.

But the rain soon began to patter, so Harry wound up the kite string, and walked home, surrounded by his companions, who never tired of praising his wonderful kite.

That morning Harry had stood looking, first anxiously out of the window at his playmates, who were flying their kites in the meadow, and then wistfully at his uncle, who was reading a book.

"What are you waiting for, Harry?" said his uncle, as he noticed Harry's furtive glances out of the window.

"I was watching my schoolfellows flying their kites," answered Harry hopefully.

"And wondering when I would make the one I promised you, eh, Master Harry? Well, fetch me the materials."

Harry bounded off, returning in a few minutes with a strip of pine wood and a piece of rattan cane in one hand, and a ball of thick twine and a sheet of pink tinted paper in the other.

"Shall we get it done to-day?" asked anxious Harry, as he laid the materials upon the table.

"That depends upon how our materials turn out. The first thing we must determine is to make the very best kite we can from the materials we have, and next we must try to make it as quickly as we can."

"What shape is it to be, Uncle?"

"A good question, Harry; and since you want the best kite, it must, of course, be of the best shape."

"But what is the best shape?"

"Let us see if we can find out. A kite flies when the pressure of the wind strikes it in a certain direction. You know this because of the position in which you fasten the twine to the belly-band. But let me make you a sketch that you may understand it better; there (Fig. 1) is a kite with

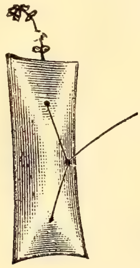


Fig. 1.

the string fastened to the middle of the belly-band. It stands, you see, upright, and the wind twies to blow it away without lifting it up at all; but if you fasten the twine higher up, as in this sketch (Fig. 2) the kite will stand aslant, and the wind will lift it. You see then, Master Harry, that it is the direction in which the wind strikes the surface of the kite that causes it to fly."

"Yes, Uncle, but if you fasten the twine as you have made it in the first sketch, the kite will sweep round and round, and sometimes come down head foremost."

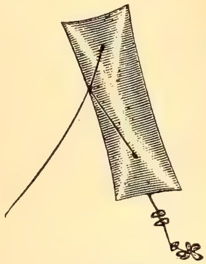


Fig. 2.

"That will always occur when the pressure of the wind is greater above the point of the belly-band, where the string is fastened, than if it is below. Suppose you were to fasten the twine below the centre of the kite, as in Fig. 3; then all the surface

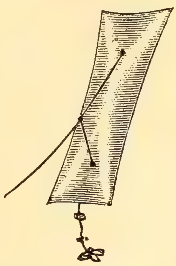


Fig. 3.

of the kite above the point where the belly-band is fastened, would be acted upon by the wind in a direction to keep the kite down to the ground, while only the surface from that point to the bottom of the kite can serve to counteract this, even when the kite stands upright; but when it slants over, as in Fig. 3, all the surface of the kite is being blown by the wind down towards the ground."

"But why should it sweep round and round, Uncle?"

"Because the surface above the fastening point of the belly-band tries to keep the top of the kite downwards, and the weight of the tail tries to keep it upright. The

gusts of wind strike the top a little more forcibly, and it begins to duck. You will notice that at every sweep or circle the kite makes, it gets nearer to the ground, and it usually strikes about head foremost. This is because when the head of the kite is moving on the downward side of the circles of its sweep, it does not feel the weight of the tail, and so moves very fast, while when it is sweeping with the top of the kite upwards it has to pull the tail after it, so it comes down with a spiral movement like this (Fig. 4), the head of the kite always

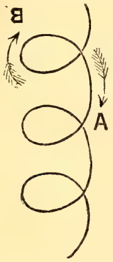


Fig. 4.

pointing downward on one side of the circles, as you see by the arrow, A, and always pointing upwards on the other side, as you see by the arrow, B. Now, if you notice, Harry, you will see that as the kite travels downwards on the A side, it must always strike the ground on its head or on its side. But your questions have rather led us away from the consideration of the shape of the kite, though in answering them I have shown you that the best shape will be that which will keep the surface of the kite as near flat as possible, while whatever bag there may be shall be in a direction to lift the kite, for you will notice that the bag of the face of the kite will always be in the same place, no matter where the string is fastened to the belly-band. Here is a kite of the square kind (Fig. 5). You see from the shade upon its face that its frame is composed of two pieces of wood, crossed at the middle, and supporting the paper across corners, so the paper between the supports bags or bends to the force of the wind. Now, look at the division marked 1, and you will see that its bagging throws its surface slightly in the direction of that of the kite shown in Fig. 3, and so tends to keep the kite from flying so well as it would

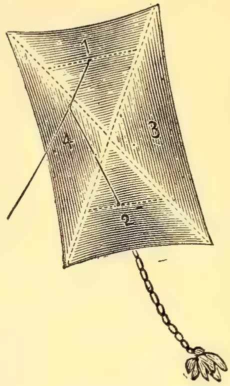


Fig. 5.

do if the bag was not there. The directions of the bagging of the divisions 2, 3 and 4, do not act to stop the kite from rising."

"What makes the face of the kite bag that way, Uncle?"

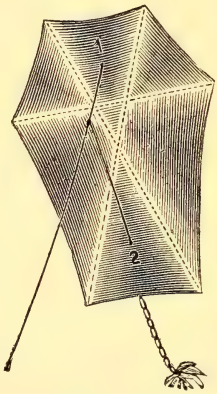


Fig. 6.

"Because the frame gives way to the force of the wind. In fact, Harry, it is a weak form of frame, depending only on the twine which ties it together to keep it in shape and stiff, and as the paper cannot be stretched tight on the frame, the bagging is sure to take place."

"Would a big square kite bag too?"

"Yes, and the larger the kite, the more it would bag in proportion."

"The edges of the kite you have drawn don't look square; what makes that?"

"Because you cannot take a flat surface and bend it in any direction without making its length or width smaller, so where the paper bags, the size across of the kite becomes smaller, and as this gives less surface for the wind to blow upon, the kite won't fly so well."

"Square shaped kites seem to have a great many faults."

"I haven't told you all yet, for the belly-

"Because they can be made easily and cheaply. Now, here (Fig. 6) you see is another shape of kite, each stick forming the frame being represented by a dotted line. See what a number of them there are—three in all; so such a kite must be heavy."

"Don't heavy kites fly well?"

"No, Harry; just think for yourself a moment. There is just so much pressure of wind trying to lift the kite, so the less the kite weighs for its size, the easier the wind can lift it."

"Why do they put tails on them; they weigh something?"

Fig. 8.

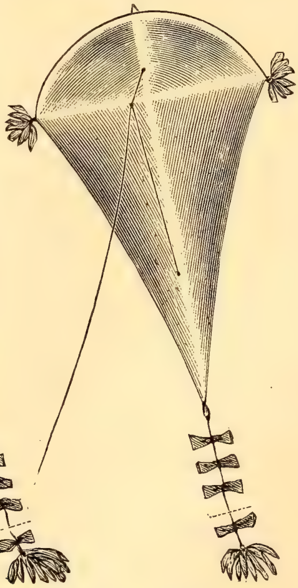


Fig. 7.

band must be fastened in the middle of the width of the kite, and as the frame don't come there, a piece of twine must be fastened across the frame, as you see by the dotted lines in Fig. 5, to fasten the belly-band to; then all the pull on the belly-band tries to pull the frame together, and this helps to make the kite face bag, and often causes the belly-band to tear the face of the kite by pulling the string, marked in dotted lines, through it."

"Why, then, do they make square shaped kites?"

"We shall come to that part presently; first let me call your attention to the fact that this kite still has the bag in the division 1, and lesser bags in the other places; and you remember that all the bag above the point where the string is fastened to the belly-band, acts to keep the kite down."

"What is the reason that the division marked 2 don't curve at the edge so much as that marked 1?"

"Because that marked 2 is kept straighter by the weight of the tail. Now, Master Harry, I have shown you some of the worst

forms of kites, and here is a sketch of the kite we are now going to make, which is one of the best, if not the very best we can select. One view (Fig. 7) is looking at the kite nearly full faced, and the other (Fig. 8) is looking at its side. The frame is composed of two pieces, one a straight piece, to which the tail is fastened at one end, while the other end, to which the bender is fastened, protrudes above the top of the kite in a point, as you see. The bender is a piece of rattan cane fastened near the top of the straight piece (which is called the standard), and bent around on each side, extending as far as the wings you see on each side. Now, look at the side view, Harry, and you will see that the bag of the paper is all in a direction to make the wind lift the kite."

"How large shall we make the kite, Uncle?"

"Let me see the twine you are going to fly it with, and then I will tell you. Oh, it is carpet thread, is it; well that is strong enough to fly a kite at least two feet high, so that shall be the height of *our* kite."

"Should the size of the kite be made to suit the strength of the string?"

"Yes, Harry, when you have got the string it should, because you can make the size of the kite to suit the strength and weight of the string, but you cannot alter the size of the string or twine. If you had not bought the twine, we could make the kite any convenient size, and then buy suitable thread or twine."

"Is it the size or the weight of the twine that is important?"

"First, Harry, the twine must be as light as possible, for it is a load that the kite has to carry. It must be strong enough to easily hold the kite, and it should be a closely twisted twine, so that it will not unravel and lose its strength, by being wound up and unwound."

"What part of the kite do you make first?"

"In everything that man constructs, Harry, the foundation or frame is made first. In this case it is the frame. Here we have a straight piece of pine wood for our standard; it is a yard long, and as we only want two feet of it, we must cut off one foot, and we will cut it off at this end, because it contains a knot that we shall then get rid of."

To be continued.

A Good Ten-Dollar Boat.

BY FRANKLIN VAN WINKLE, M. E.

WHO does not enjoy riding in a rowboat? It is one of those innocent pleasures which furnish healthful outdoor exercise, and is equally delightful to old and young, rich and poor. And how much pleasanter the sail when the boat is one's own, provided it be neat in appearance, easy to manage, and, above all, safe. There are many persons living near streams and sheets of water suitable for boating, who would be both benefited and entertained, during most of the spring and summer months, had they a nice boat at their disposal.

Keeping a boat is generally regarded as involving a great amount both of labor and expense; this is true only when its care is attended with bad management and false economy.

The best and safest boat is commonly known as a "round bottom." A good round bottom boat, however, cannot be purchased for less than seventy-five dollars, and such an outlay, especially in these times, is within the reach of but very few. The points of excellence in a pleasure boat are safety, strength, lightness and speed. The amateur boat builder might at first build a good flat-bottom, of which, by the way, there are but very few; and it is believed that if he diligently follows our instructions, he will be so successful as to attempt the construction of a round-bottom, after similar directions to be given at a future time.

To those who have been accustomed to see only the staunch and spacious jolly, or round-bottomed boat, or the light and graceful racing shell, the idea of the above qualities being combined in a skiff or skow,

may seem ridiculous. But recent experiments have shown that a flat-bottomed craft can be constructed which will surpass in speed yachts of the most improved lines, though they are by no means as elegant in appearance, and far more liable at a shift to capsize. The latter objection cannot be overcome in a sailboat of this description, for an increased breadth of beam makes her only the more difficult to manage—hence the usual remedy for round-bottom crafts would, in the instance of a flat-bottom, have just the opposite effect.

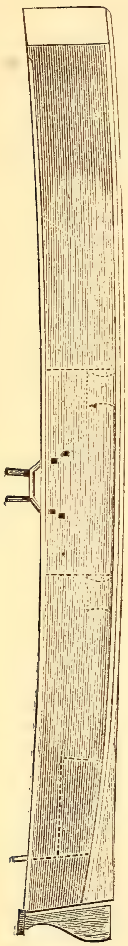


Fig. 1.—SIDE VIEW.

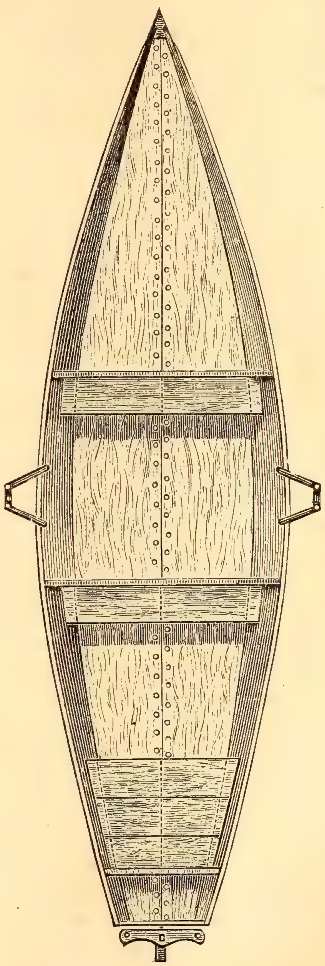


Fig. 2.—GROUND PLAN.

But for smooth water these objections do not extend to flat bottoms which are propelled by oars or by similar means, for, by proper proportions, ordinary workmanship, and a judicious selection of materials, a flat-bottomed boat may be constructed which will surpass the most sanguine expectations, even of its builder. Before the comparatively recent construction of sharpies, little or no attention was given to the proportions of boats of this description. After a careful consideration of the best method of constructing an ordinary sized boat, in which should be combined speed with lightness of draught, the following dimensions

were decided upon to carry two or three persons, though when built, this boat carried with safety nearly eight hundred weight.

the sides while the boat is in course of construction. Fig. 7 (see next number), longitudinal section through stem post or cutwater; Fig. 8, cross section through same.

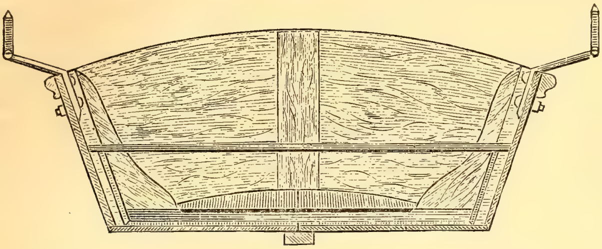


Fig. 3.—MIDDLE CROSS SECTION.

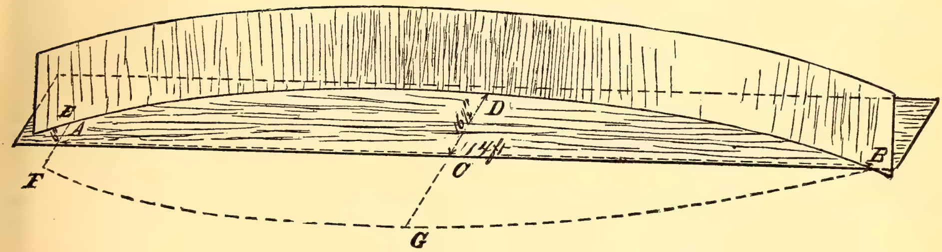


Fig. 5.

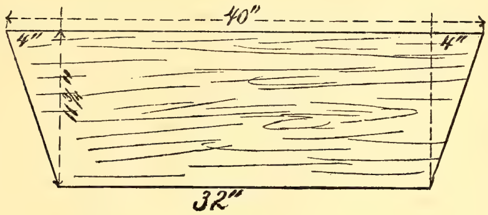


Fig. 6.

With the aid of the accompanying sketches and diagrams, we will proceed to describe this boat, and then give the method of its construction. Fig. 1 is a side view; Fig. 2 is the ground plan, and (upon a larger scale) Fig. 4, stern view, rudder removed; Fig. 3, middle cross section, looking forward. Fig. 5 shows method of marking out one of the bottom boards by the use of the other. Fig. 6 is a diagram showing shape and dimensions of cross-board used for a temporary brace between

Length over all (stem and stern)........	14	feet
Breadth of bottom at middle of length..	33	inches
Rake of sides (each) at middle of length.	4	"
Breadth of bottom at stern.............	12	"
Rake of sides (each) at stern............	1½	"
Depth of sideboards in main............	14	"
" " at stern............	10	"
Rise of stem and stern above gunwale at point of greatest flare................	6	"

The bottom and sides are of half-inch clear and well seasoned white pine, planed smooth on both sides. To insure symmetry and a better balance, both sideboards might

be sawed from the same plank and the same way with those of the bottom.

For the sides get two boards 14 inches wide and 16 feet long; and for the bottom two boards at least 15½ feet long by 17 inches wide. Laying down one of the bottom boards on an even floor, select two points (A and B, Fig. 5) 14 feet apart, the edge having been previously straightened and squared. Midway between these two points, as at C, scribe or draw a line square across from this edge, and mark a point, D, 16½ inches back from the edge, A, B. In the same way locate the point E 6 inches back from the point A. The points B, D

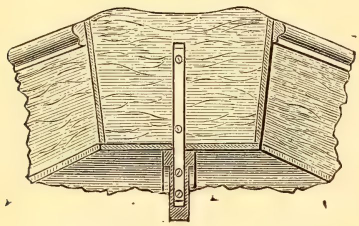


Fig. 4.—STERN VIEW.

and E being determined, stand the second bottom board on edge upon the first; bend it (dry) so that its lower outside edge passes through B, D and E. Then the curved board being held only at these points, mark the flat board around the outside of the curved one.

You now have the form of one-half of the bottom, A, B, D, E, which may be sawed out with a narrow cross-cut saw; and then, being trimmed with a smoothing plane, it may be used as a template or pattern for marking out the other half.

Laying these two bottom boards together, edge and edge, they will have the appearance of B, D, E, F, G (Fig. 5), which will be practically the same as the ground plan of the bottom, as shown in Fig. 2.

To be continued.

Popular Fallacies.

WE find the following paragraph going the rounds of the papers, and occupying a prominent place in the "Science Columns" of the religious and secular weeklies:

WHAT THE MICROSCOPE REVEALS.—1. Mold is a forest of beautiful trees, with branches, leaves and fruit.

2. Butterflies are fully feathered.

3. Hairs are hollow tubes.

4. The surface of our bodies is covered with scales like a fish; a single grain of sand would cover one hundred and fifty of these scales, and yet a scale covers five hundred pores. Through these narrow openings the perspiration forces itself like water through a sieve.

5. Each drop of stagnant water contains a world of living creatures, swimming with as much liberty as whales in the sea.

6. Each leaf has a colony of insects grazing it, like cows in a meadow.

It would be difficult to string together a series of sentences containing more errors. We have numbered each sentence, so as to refer to it with greater ease.

1. Mold is very beautiful, but the last thing to which it can be compared is a forest with *leaves*. Mold has no leaves.

2. Butterflies have no *feathers*. They are covered with scales, and these scales bear no resemblance to feathers.

3. Hairs are not "hollow" tubes. (Did the writer of the above ever see a tube that was not hollow?) Hairs are much more solid than a piece of ordinary wood. The popular mistake of supposing that hairs are tubes arose from the fact that every polished cylinder shows a bright streak down the centre when viewed as an opaque object. A common lead pencil shows this well.

4. The scales which cover our bodies are considerably different from fish scales.

5. This statement is more nearly true than any of those which have preceded it, and yet in regard to most stagnant water it is grossly exaggerated.

6. As regards the majority of leaves, the last statement is ridiculous. The expression, "grazing it, like cows in a meadow," is decidedly rich and laughable. Insects generally eat the leaf itself, they do not "graze it." But if the leaves are from healthy trees, our young friends may examine thousands of leaves with the microscope without finding a "colony of insects."

THE

YOUNG SCIENTIST.

PUBLISHED MONTHLY.

TERMS—Fifty Cents per year. ☞ Postage free to all parts of the United States and Canada, except New York City. Our absurd postal laws make the charge for delivering our journal to subscribers in New York city five times as great as that required for transporting it across the continent, and delivering it to subscribers in San Francisco or New Orleans. We are therefore compelled to charge our New York subscribers 12 cents extra.

ALL COMMUNICATIONS should be addressed to

THE YOUNG SCIENTIST,

P. O. Box 4875. 176 Broadway, New York.

☞ For Club Rates, etc., see PROSPECTUS.

Our Summer Numbers.

DURING the next four months—May, June, July and August—we shall give special attention to matters connected with out-door studies, sports and pastimes, deferring such matters as chemical and electrical experiments, etc., until fall and winter.

In the present issue we commence two articles which cannot fail to interest our readers. The first is devoted to the kite, and gives very fully and clearly the scientific principles upon which that interesting toy should be constructed. From this point of view it cannot fail to interest older readers than those who usually construct kites.

The other article describes the construction of an easily and cheaply made, but very serviceable boat. The description is so full, and is made so clear by means of the engravings, that any intelligent boy who can handle a saw, a plane and a hammer, ought to be able to make one. The engravings and description are no fancy sketch, but are the details of the experience of one who actually made such a boat. The boat is now in use, doing good service, and the forms and dimensions laid down in the article are exactly those that were employed by the builder.

We have also in preparation two series of articles which cannot fail to interest a large circle of readers. The first is, "How to Begin the Study of Botany," and gives directions and hints for the use of beginners who are anxious to commence this study, but have no teacher. We have also in preparation a series of articles of a similar kind on entomology, so that our young friends who are collecting insects will be able to make an intelligent study of the subject.

We have also on hand other articles suitable for summer days.

Our Prizes.

QUITE a number of young people have gone earnestly to work to compete for the premiums offered in our March number. These prizes are all the very best of their kind, and our young friends may rely upon it that there will be perfect fair play. There is still abundant time for any active, earnest boy or girl to get up a good club, and stand a good chance for a valuable prize. This is more especially true, from the fact that some of those who have got up the largest clubs, being doubtful of their success, have preferred to make sure of the cash commission.

A Word to the Girls.

WE find that quite a number of young ladies have become subscribers to our journal. Of course, many of the subjects which we take up are of very little interest to them individually. Few of them, we fear, will care much for the turning-lathe or the vice-bench, though we know of several girls who have executed beautiful work with the scroll saw. It is true that some of our young lady friends take an interest in our articles for boys, because they learn from them how to give pleasure to

their younger brothers. For example, the article on kites has been inquired about by some of our lady subscribers, because they wished to find out the best way of making a kite to amuse some little boy. But we do not intend that the unselfish nature of the girls shall be taxed too severely, and we promise them important aid in their own special departments. Of course there is a wide range of subjects common to both boys and girls. Thus, the microscope, about which we shall always have at least a couple of pages, is used quite as frequently by girls as by boys, and often more efficiently by the former than by the latter. So, too, all subjects which merely give information, such as most articles on natural history. The care of pets, too, is often as great a source of pleasure to girls as to boys. But in addition to all this, we have made provision for special articles on subjects peculiarly interesting to girls, and such as they are not likely to find discussed in journals published exclusively for ladies.

Microscopy.

A Cheap Condensing Lens.

SUCCESS in the use of the microscope depends very largely upon proper management of the illumination. Some objects require a soft and subdued light; others demand the most intense illumination that can be obtained, and the various ways in which the light ought to be modified so as to produce the best results, are more numerous than most persons are aware of. Amongst the numerous accessories used for purposes of illumination, none are more useful, or give better results, than the condensing lens or bulls-eye condenser. And here let us explain the difference between these two: The bulls-eye condenser ought to be a hemispherical lens; a condensing lens may have any degree of curvature.

Until within a few months the condensing lens has been a somewhat expensive accessory, none being for sale at a less price than four to ten dollars. We have so often obtained really good results, however, by means of very cheap and simple arrangements that we shall describe a simple affair which we once made, and which seemed to work about as well as far more expensive articles. Any intelligent boy or girl can make one.

The thing that is required first is a suitable lens. We found that one of the best lenses for this purpose is what is called by spectacle makers a *cataract* lens, of as high a power as can be had; No. 2 answers very well. Such lenses have a short focus—about 2 inches—and are about an inch and a half in diameter. The cost varies from 15 to 25 cents, according to the profits demanded by the dealer.

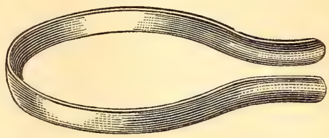


Fig. 1.

Where a cataract lens cannot be had, very good work may be done with some of the cheap lenses sold for burning glasses. In general, however, they have too long a focus. A good substitute for a lens is a small glass bulb filled with water. This we shall describe at some future time.

Having procured a lens, the next thing is to mount it. This is easily done. Get a common letter file, such as can be had for

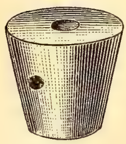


Fig. 2.

10 cents, or make one by inserting an upright wire in a block of wood, as shown in Fig. 3. Procure also a good bottle cork; a piece of wire about 6 inches long, and one-eighth of an inch in diameter; and a strip of tin about three-eighths of an inch wide and six inches long. Bend the tin into a loop, as shown in Fig. 1, the loop being the

exact size of the lens. The ends of the tin strip should be made narrow and hammered into a half-round form, so as to clasp the end of the wire, which should then be placed in the tube thus formed, and soldered there. A little care will be required in making the exact measurements, and fitting the loop so as to get it just the right size to hold the lens. If it should be a very trifle too small, the lens may be ground down on a common grindstone. If it be too large, it may be filled up with a second ring of tin, or even cardboard.

To fasten the lens in its place, various devices may be used. We fastened ours with sealing-wax, and it answers very well. This was done by heating the loop until it would melt the wax, and then coating the

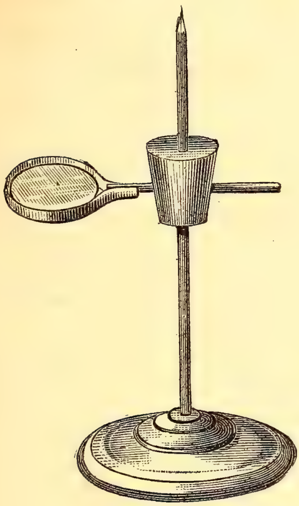


Fig. 3.

inside of it with that material. While the wax was still soft, the lens was pressed to its place, and the loop was again gently heated, so as to cause the wax to adhere to it firmly. A more mechanical and artistic method would be to get two rings of sheet tin, each an eighth of an inch wide, and of just such a size as would fit into the inside of the loop. These two rings are to be soldered to the loop, the lens being between them. Various other ways might be suggested, but the sealing-wax answers very well.

The next step is to connect the lens and its frame with the stand, and this is done by means of the cork. Two holes are bored through the cork, as shown in Fig. 2, one passes lengthwise through the centre, and the other hole passes through the cork at right angles to the first, and a little to one side of the centre. These holes can be made by means of a cork-borer, which is a small tube of sheet tin or brass, with the edges sharp; or they can be made by first passing an awl through the cork, and then enlarging the hole to the proper size by passing a red hot wire through it—an old knitting needle answering very well. As soon as the holes have been bored, the whole may be put together as shown in Fig. 3, and the condensing lens is complete.

The simplest and most obvious use of the condensing lens is to throw light (either daylight or lamplight) on opaque objects, examined by reflected light; and upon this and other uses we shall have a good deal to say in future numbers.

Correspondence.

A Fifteen-Cent Battery.

Ed. Young Scientist—Last year I constructed a cell of the carbon battery very cheaply. All that is needed is a glass fruit jar holding one quart, a piece of carbon (charcoal), and a piece of zinc. An old can will answer, or take a large quart bottle, and, with a glass cutter, cut the top off, which will make a good jar. You can get an old zinc at almost any telegraph station, or you can roll one out of sheet zinc, which will do as well. Make it 1 inch in diameter by 6 inches (or the height of can). Go to a tin shop and they will give you a piece of carbon (charcoal) same size as zinc; solder a good wire to the zinc, and drill a hole in the carbon and place a wire in it; place between the carbon and zinc a couple of pieces of rubber or wood; place a tight rubber band around them to hold them, and place them in the jar.

The solution is made by heating one quart of rain water to the boiling point, adding three ounces of bichromate of potash, and stirring

until it is all dissolved. Let it cool to blood heat; then add three liquid ounces of sulphuric acid. When cold it is ready for use. One cell of this battery is equal to six or eight tin can batteries.

This battery you can keep for years, and when you want to use it pour in the fluid and it is ready. It starts with full force.

H. A. KINNEY.

Hamlin, Kansas.

[The above is a very simple method of making a good battery, but it costs a good deal more than the tin can battery. Thin zinc does not last long in such a battery, and it is not always that a heavy zinc can be had for the asking. Well burned coke will be found to give better results than ordinary charcoal.—ED. A. J. M.]

BOOK NOTICES.

Hints to Plumbers and Householders. By W. L. O'Grady. With illustrations. New York: American News Company.

The numerous cases of sickness which have recently arisen from defective sewerage, many of them terminating fatally, has called renewed attention to the system of plumbing usually pursued. This little book explains the best methods of securing safety, and gives very complete figures of all the best arrangements in use. To the plumber it will be valuable, from the fact that it contains a great deal of useful statistical information and data in a compact form, while the householder must prize it from its clear and popular discussion of the general subject.

Exhibition of National Academy of Design.—The fifty-third annual exhibition of the National Academy of Design is now open, and presents a rich feast to lovers of art. It is generally conceded that the present exhibition exceeds in interest anything that has gone before it, and certainly many of the paintings now on the walls deserve hours and hours of continuous study. In the limited space at our command it would be impossible to enumerate even the most prominent paintings on exhibition, while to single out a few would be invidious. We trust, however, that many of our young readers will visit the exhibition again and again, to see them and study them for themselves, for we know of no way in which a few evenings can be passed with greater pleasure, and certainly of all the exhibitions now open to the public, none has a more elevating tendency. It is hardly necessary to say that the rooms are at the corner of Fourth avenue and Twenty-third street.

EXCHANGES.

In this column yearly subscribers who may wish to *exchange* tools, apparatus, books, or the products of their skill, can state what they have to offer and what they want, *without charge*. Buying and selling must, of course, be carried on in the advertising columns.

A good telegraph instrument, cost $7 50, for a couple of good books on chemistry, electricity, etc. H. B. Kinney, Hamlin, Brown County, Kansas.

Wanted to exchange, a stencil outfit for a Barnes' scroll and circular saw, foot power; or a good battery for electro-plating; or an artificial incubator; or state what you have to exchange; reason for exchanging is the partial loss of right arm; all letters answered, Barton A. Whitsett, Box 115, Lebanon, Ind.

A large number of minerals and fossils for exchange. Persons wishing to exchange please send list to W. H. Hughes, 47 Jeff. Avenue, Grand Rapids, Mich.

Wanted in exchange for a second-hand scroll saw, treadle power and wooden frame, a good Excelsior microscope, or live box. Jos. G. Thorp, 54 West Seventeenth street, New York.

A set of chemicals and apparatus; also a set of wood engraver's tools, glass and instruction book, to exchange for a scroll saw and a microscope. The chemicals and tools cost nearly $40; will give a good trade. F. H. Jackson, Angelica, N. Y.

To exchange, a Pope's air pistol for a set of carving tools. L. Y. R. G., Box 317, Brookfield, Mass.

Cigar machine to exchange for bracket saw or good microscope. Leonard Alexander, Linneus, Me.

Wanted, a small turning lathe in exchange for a pair of telephones. J. C., care YOUNG SCIENTIST.

Magic lantern, nine slides (two mechanical) in complete order, in exchange for good compound microscope. T. R. Barwood, Flatbush, L. I.

A work on painting and wood finishing, value $1.50, to exchange for scroll saw patterns. R. F. Hanscam, North Barnstead, N. H.

Gold watch (cost $150) in exchange for a good microscope. E. W., Box 4875, New York.

Wanted, a xylophone in good condition; a Centennial jig saw, bought in December, in exchange. C. B. Culver, 131 East Seventeenth St., New York.

Back numbers of the "Youth's Companion," for the years 1876 and 1877, cost $1.75 a year; lathe, for Centennial bracket saw; or "The Speaker's Garland," Vol. 2 or 3. F. R. Miller, 750 East Fourth street, South Boston, Mass.

Scroll saw wanted in exchange for handsome portfolio of six water color sketches. Address F. S., care Box 4875, New York.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. H. A. Cutting, State Geologist, Lunenburgh, Essex County, Vt.

Thorough and practical instruction in shorthand will be given in exchange for a microscope, with or without accessories, worth from $5 to $10. Address T. P. Wendover, 68 Christopher street, New York.

Wanted, a small turning lathe, about 1½ inch swing, and 12-inch bed; must be well made; books and apparatus in exchange. R. M., care of this journal.

Wanted, a copy of Holtzapfel's "Mechanical Manipulation." State what is wanted in exchange. E. W., Box 4875, New York.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A Popular Record of Scientific Experiments, Inventions and Progress

VOL. I NEW YORK, JUNE, 1878. No. 6.

How to Study Entomology.

BY F. C. SMITH.

I.

In presenting a series of articles on the study of insects, it is hoped that an interest will be created among our young readers that will lead them not only to the collection of specimens and filling of cabinets, but also to study their habits and transformations.

Of late there seems to be an increasing interest taken in this, one of the most absorbing branches, of natural history.

In the following articles care will be taken to use terms that may be readily understood by those who we hope will be interested, and drawings of the necessary apparatus will be rendered as simple and easily made as possible.

Butterflies and Moths.—For these a net will be indispensable, though for taking moths that fly by night, of which there are many varieties, they may be taken in a trap which we shall presently describe.

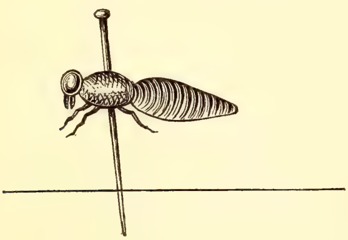
The Net.—For a net a simple wire hoop about twelve inches in diameter is best, fastened to a pole five feet long, which should be light enough to use with one hand, as occasion will require. Telegraph wire may be used, though a size larger is better. The ends should be bent to run down the sides of the pole four or five inches. It can be fastened by winding tightly with fine wire, or a blacksmith will form a shank on the hoop for a few cents. To this hoop should be sewed a bag of Swiss muslin, tarlatan, or mosquito-netting, about twice as deep as the diameter of the hoop; or a border of strong cloth may be sewed to the bag, and this to the wire. In using this net, when you have caught your specimen, give the net a half turn, and you have it a prisoner in the fold hanging over the wire. The same net is used for all insects that are caught on the wing.

The Collecting Box.—A large flat cigar-box makes a convenient receptacle for all insects

that require to be pinned. A better one is made by using two cigar boxes, fastening the lids together with short screws. A cushion or piece of cork for pins should be fastened at one end of the box. As the specimens must be made secure, it is a good plan to line the box with sheet cork, or melted beeswax, to prevent bending the pins by pressing into the wood. The whole may be suspended from the shoulder by a cord, or fastened by a strap to the waist. The pockets of the collector should at all times be well stocked with pill boxes, of different sizes, in which may be placed any odd specimens that are sure to turn up when least expected.

Stupefying.—After catching a butterfly or moth, it should be given a dose of ether or chloroform (sulphuric ether is best), of which the collector should carry a vial. A penny paint brush stuck in the cork is handy and prevents waste. By touching the mouth of the captive with the moistened brush, it will at once become happy and entirely oblivious to the operation of pinning, which, if done without stupefying, is both cruel and inconvenient.

Pinning.—Now take your specimen from the net, and, holding it by the under side of the body, in the fingers of the left hand, thrust the pin in at the centre of the thorax (the second division of the body), and out



between the second and third pair of legs, as seen in the cut. Some moths will bleed a little when first pinned. A piece of blotting-paper will quickly absorb the blood, and prevent it soiling their plumage. The specimen may now be pinned in the collecting box, and if after a while it revives, apply another dose of ether, thus keeping it from fluttering, and insensible to pain.

Killing.—Some prefer to kill specimens as soon as caught, by the use of a wide-mouthed cyanide bottle, small enough for the pocket. To make this, procure at the druggists one or two ounces of cyanide of potassium, and powder it. Put two or three layers of the poison into the bottle, with pieces of blotting paper between the layers, and one piece cut a little larger than the inside of the bottle, to put over all. Press this down firmly, letting the whole fill the bottle about one-quarter full. For home use, a jar the size and shape of a candy jar, with a wide mouth, may be prepared, of course using more of the poison. Keep this well corked or covered, as the fumes are very poisonous. Into this jar put any specimens that are brought home stupefied with ether. No harm will be done if insects are allowed to remain in the jar over night—in fact they will become pervaded with the poison, and it will tend to preserve them.

Setting.—When taken from the jar, they should be immediately set on the mounting board, as shown in another article in this journal. They must remain set until rigid, requiring from two or three days to a week, according to the size. The wings must not droop; if they do, let them remain longer on the mounting board. In setting butterflies and moths, never put a pin through the texture of the wings. A needle driven into a penholder may be used to manipulate the wings, holding them forward with pins driven in the board.

The primary (forward) wings should be carried forward enough to show all the markings of the secondary (back) wings.

The fore feet, tongue and antennæ may be arranged according to fancy, and they will always remain in the position in which they dry.

Entomological Pins.—These are manufactured especially for the use of collectors, and may be obtained from dealers in naturalist's goods. They are made long and slim, that the specimens may be set well up

from the bottom of the cabinet case, the reason of which will be told later. Two or three sizes will be needed for butterflies, moths, beetles, crickets, grasshoppers, bees, wasps, etc. For mounting smaller insects, another method will be explained in our next.

Relaxing.—Sometimes a specimen, overlooked, or presented by a friend, becomes rigid, or has its wings closed, and it becomes necessary to relax it before it can be set. This may easily be done by pinning the specimen to a cork, and on this let it float in a dish of water, covering it with a damp cloth. Damp sand covered with blotting paper will serve the same purpose. From four to eight hours will suffice, as a longer time tends to cause mold. Specimens may thus be set as easily as when just killed. Mold may be destroyed by brushing the insect with benzine, to which a little creosote has been added.

General Hints.—For handling insects, a simple pair of tweezers will be convenient; also the pliers described on page 57 of the Young Scientist. After removing butterflies and moths from mounting board, they should be stored in a dark place until the cabinet cases are ready to receive them. Tight boxes must be used for storing, as specimens are liable to be attacked by a small beetle or fly, which will eat away the body of a large moth to a mere shell. A fine dust under the insect will betray its presence. A piece of gum camphor should be placed in storing boxes.

Record.—A record should be kept of all specimens, giving each a number, and entering this number in a blank book ruled to record number, name, locality, date, donor or collector, and notes concerning capture, etc. The numbers may be home-made, or library numbers can be bought in sheet form for a trifle. Keep each number with its insect, on the same pin if desired. The Latin names may be filled in the record at any time afterward.

There are several good text books on entomology, with which all insects may be named and classified. The editor will at any time advise as to what works are preferable.

In our next article we will give directions for sugaring, also design for a moth trap.

To be continued.

The Champion Kite, and How it was Made.

By Joshua Rose. M. E.

Concluded from page 65.

"WHAT difference does the knot make, Uncle?"

"The stick is weaker where the knot is; we want our standard strong and light, and so even in strength that it will bend with an even curve throughout. There, now the end is cut off, and we must cut the stick down to the proper size. You see it is crooked, and in paring it down we must straighten it. Every now and then, you see, I stop paring it, and lay it down upon the table and turn it over and over, to see where it is crooked, and then pare off the high places. Here, you see, is our standard (Fig. 9) all ready; it is made with flat

Fig. 9.

sides, because we can more easily make it straight, and it will hold the bender more firmly. It has a small notch at the top for the twine that binds the bender to fall into, so that it can't move, and a little notch at the bottom for the string from the end of the bender to fall into, as you will see presently. Now for the bender, which must be rather shorter than the standard, say one-

sixth shorter, so in this case it must be 20 inches long. It should not have a knot or joint in its entire length, but, as we cannot find that length clear of a joint in this piece of rattan cane, we will let a joint be in the middle of its length, where it won't interfere with the bending. This, you see, is the straightest part of the cane, so we will cut it off 10 inches on each side of this joint.

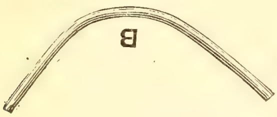


Fig. 10.

Now we must go to work and split the cane, for it is too thick and heavy, as it does not require to be more than the thickness of a slate pencil at the ends, and a little thicker than a lead pencil in the middle. There, you see, it has split pretty even, and now we will round it up."

"Why do you make it smaller at the ends, Uncle?"

"To make it bend with an even sweep. Let me show you on this spare piece of unsplit cane; there, do you see (Fig. 10) how uneven it bends, and how ugly or misshapen it seems. This is because the ends are too strong to bend, so we must make them weaker by tapering them off, and the more even we taper them, the more even or regular the bend will be. Now we have pared them down nearly small enough, we will straighten them by laying, one end at a time, on the table, to see where the high or protruding crooks are, and scrape them away with our penknife. Now, you see, they look alike, but we must test our work; so let us find the middle of the length. We cut off this piece of twine to the full length of the bender, and then bring the ends even and double it up. Now place one end of the doubled twine at the end of the bender, holding it straight along the bender, and where the other end comes is the middle of the length of the bender, so we cut a small notch there to mark it. Now rest the notch on the back of the penknife blade, so (Fig. 11). You see it does not quite balance, so we must take more off the heavy side, and try it again. Now you see it pretty nearly balances, so it will do for the present, but let us notice which is the heavy side, for that knowledge may be useful presently."

"What difference does the balancing make?"

"If one side is heaviest, it will cause the kite to lean over on that side, and, in all likelihood, that side is the thickest, and won't bend so even. In that case there will be more face on the kite on one side of the standard than on the other, and then the wind will put more pressure on that side, and the kite will wag, or sway about, when you fly it."

"I didn't think it took so much care to make a kite."

"It does to make a good one, that will fly high, keep steady, and look stately.

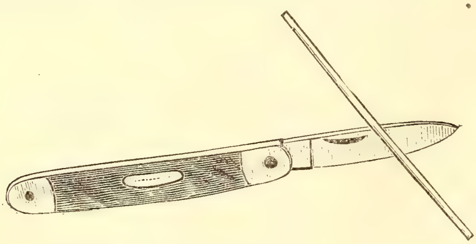


Fig. 11.

Now let us tie the bender to the standard, taking care to tie it exactly in the middle, where the notch is. Here it is (Fig. 12), you see, all ready to bend. Now we make a fine notch close to each end of the bender, and tie a string or twine to one end, then pass the other end round the other end of

the standard, and up to the other end of the bender, drawing it tight, so as to spring the

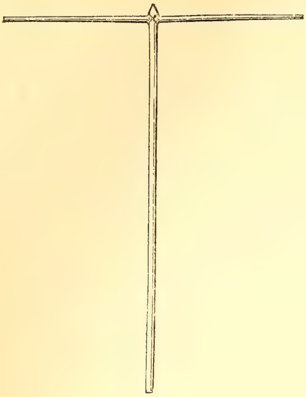


Fig. 12.

bender to a bow shape, just as you see in Fig. 13. Now you see that one side is bent more than the other, the side A being the least bent. Now, let us see if that isn't the side that was a little the heaviest when we balanced the bender. Yes, it is; I thought so. Now we will take a piece of sandpaper and reduce that side a little, and that will

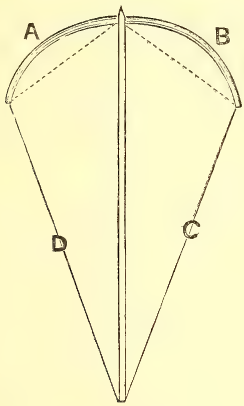


Fig. 13.

make the bend and the weight both right. If you want to see how much it is out of true, just look at the distance between the dotted lines and the bender on each side. Our sandpapering you see has made it just right."

"But suppose the bender had been exactly balanced, and then didn't bend right, Uncle?"

"I am just coming to that, Harry. You see that, in Fig. 13, one side of the bender is marked A, and the other B, while the string bending it is marked C on one side and D on the other. Now the lengths of C and D must be just equal, and we make them equal by slipping the twine in the notch, which, you remember, we made in the end of the standard, that is at E. When we have made them equal, we tie the twine tightly to the standard near the end E, using another piece of twine, and letting its ends hang down in a loop to tie the tail to. Next we take a piece of twine and tie it to one end of the bender, drawing it just tight, but not enough to bend the bender, and fastening it to the standard, where it meets the bender—that is, it will occupy the position of one of the dotted lines in Fig. 13. We next fasten another piece the same way on the other side, and then, instead of the dotted lines, we shall have pieces of twine. If one side of the bender wants a little more bending, we must draw the piece of twine last added a little tighter, and if this slackens one of the lines C or D, we must tighten the latter again. We next take another piece of twine and tie it to one end of the bender, draw it just tight enough to feel the strain, and pass it straight across to the standard, tying it there; then pass it straight across to the other end of the bender, draw it just taut, and tie it there; and then our frame is made."

"Is there any way of testing if it is the right shape and evenly balanced?"

"Yes; here is our kite frame (Fig. 14) all finished, and if you measure and compare the length of A on one side with that of A on the other, you will find them equal, and so it is with the lines B on each side, and the lines C—all are of equal lengths, while C on each side is an equal distance from the curve of the bender. This proves that the frame is even shaped, and so there is as much surface, for the wind to strike against, on one side of the kite as there is on the other. Now for the balance; all we can do

is to place a loop of string around the standard at about the place where the line B B is tied, and hold the face of the kite horizontal; then we may move the loop along the standard to balance its length, and see if one side always droops when the kite frame is put slightly in motion by the finger. If it does, that side is heaviest, and

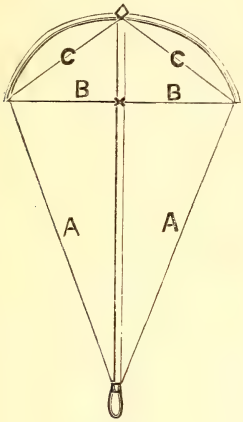


Fig. 14.

we must turn over the edge of the paper more on that side when we put it on, so as to balance the weight."

"It is a pretty looking frame."

"Yes, and what is better, it is a firm one, for the tension of the bender keeps it stiff, while it also causes the bender to keep all the strings tight."

"How is the paper put on?"

"Smooth it out flat upon the table, and cut it out, leaving a nice edge to turn over; cut notches out of the paper, to let each end of the bender, and the point at the top of the standard, come through. Then paste the edges of the paper and turn them over all round, taking care not to double the paper over too far, which would set the side strings out of straight. The kite being dry, we may put the wings on the end of the bender, as you see them in Fig. 7."

"What are those wings for; to make the kite look pretty?"

"They do add to the beauty, but they are not put there for that purpose altogether. You must know, Harry, that wind doesn't blow evenly quite, but comes in gusts, and when the wind strikes on one side of the kite stronger than it does on the other, it makes the kite sway to one side. The wings, you observe, are made of a piece of paper formed like a tassel. Suppose, then, that the wind is strongest for a moment on the right hand side of the kite, the ends of the wings are blown more behind the kite than those on the left hand side, so that the side of the kite that has the least pressure of wind on it, has most of the wing exposed to the wind, and this makes up for the less pressure, and so keeps the kite steady."

"What kind of tail shall we have?"

"Let me tell you the use of a kite tail. Many boys seem to think that the weight of the tail is what is required, but that is quite wrong, for the weight is only *one* consideration. Do the best we can, we cannot keep the kite quite steady, unless the wind blows very evenly on each side of it, which is not very often the case, and the kite always moves towards the side where the wind blows the least. To partly prevent this, we want the tail to present a good deal of surface to the air, and this will make it harder to move through the air. If you fold up a fan, you can move it very quickly, but if you open it full out, it is more difficult to move it, although its weight is the same in both cases; just so it is with a kite tail—whatever its weight may be, it will take more time to move it through the air if it presents a large surface than if it presents a less one. An easy way to get a large surface is to cut some pieces of newspaper about three inches long and an inch and a half wide, and fold them up lengthways until they are only about half an inch wide. Then make loops in a piece of twine, and fasten these pieces of paper, which are called spills, in the middle, placing them along the twine about three inches apart, and making the tail about four times the length of the kite, and putting a paper tassel on the end."

This is how Harry got the champion kite, and how it flew is told at the beginning of this story.

A Good Ten-Dollar Boat.

BY FRANKLIN VAN WINKLE, M. E.

Concluded from page 68.

THE only part of the construction requiring any degree of carpentering skill is the cutwater or stem post. This should be made next. A piece of hard wood (ash is preferable) is first cut in the form of a wedge, the angle between the sides (A, B, C, Fig. 7) being made the same as the angle between the edges of the bottom board at the point B, Fig. 5. The breadth of this wedge is equal to the main width of the side boards (14 inches) added to the thickness of the bottom (½-inch), viz., 14½ inches, and the length along either side from its point, *i. e.* from B to A or C, is equal to 6 inches. The grain may run either vertically or horizontally. Next cut, in the sides of the wedge, gains half an inch deep by 3 inches broad, as A, D, Fig. 7, in which to drop the ends of the side boards, and make them flush with the original wedge, as indicated by the dotted lines. The stem piece will then have a cross section similar to the shaded part of the figure. In the same way as for the sides, cut a step into one end of the stem post in which to drop the bottom boards, leaving them projecting about an inch forward of the joints at the ends of the side boards.

Next fit the side boards to the stem post. Cut them off on a bevel, making them 1½ inches longer on the upper edge. Fasten them to the stem piece with 1¼ inch No. 13 screws. Then remove one side, bend the other around the curved edge of one of the bottoms, and find by trial *about* where the

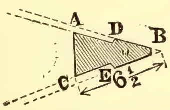


Fig. 7.—HORIZONTAL SECTION THROUGH STEM POST.

stern comes. Beginning about 3 feet forward of the stern, sweep a curve up from the bottom edge, gradually growing steeper towards the stern *at* that point, so that the side board is left 9 or 10 inches deep. Cut the curve only, and use this side board as a template after which to shape the other. The ends must not be cut off until after the stern piece has been set in position.

The side boards are then to be soaked in water for about twelve hours previous to bending. This may be done either by sinking them in water, or by winding around them wet carpets or cloths. While the sides are soaking, cut from three-quarter inch or 1 inch stuff, a cross board of the dimensions given in Fig. 6, and have this in readiness to bend your side boards around. After sufficiently soaking the sides, put them back in the stem post; then, with the stern piece resting on the point of the bottom boards, tie the sides together at the stern. Midway between stem and stern, *i. e.* where G, D, of Fig. 5 comes, insert the cross board longest side up. In this form give them at least twenty-four hours in which to take a set, but do not allow them to stand in the sun, as in that case they will be liable to twist.

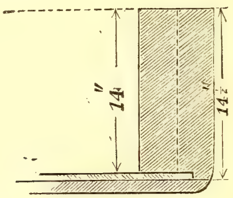


Fig. 8.—LONGITUDINAL SECTION THROUGH STEM.

The sides, after drying, being set out the proper distance apart at the stern, and tacked there, the bottom edges are planed to receive the bottom. The proper bevel is found by simply laying a straight-edge across, care being taken not to plane below the inside edges.

The bottom boards are now fitted to their seat in the bottom of the stem-post, laid in their proper positions, and, beginning at the bow, are permanently fastened with fourpenny nails to the sides.

The stern piece should then be cut from one-inch plank, and, as shown in Fig. 4, set inside of both side and bottom boards, with a

rake on each side of 1½ inches. Fasten from outside with 1¼ inch No. 9 screws, about 2½ inches apart. As there will be considerable additional strain at the upper edge of the side boards, in consequence of their flare, they should be stayed by a quarter-inch bolt passing clear across the stern, against the inside of the stern piece.

The keel, which is 1¼ by 2 inches in size, should now be fastened to the bottom. Commencing at the bow, it is first fastened to the under side of the stem piece, overlapping the joint made by the bottom, as shown in Fig. 8, and then fastened to the bottom boards from the inside, with 1½ inch No. 13 screws through the bottom, alternating them in position, as shown in the plan view, the screws on same side of joint being spaced apart three or four inches. Next finish the gunwale with a suitable molding, something like that shown in Figs. 3 and 4. Taking two pieces of proper length—one for either side—plane down the backs of one end of each for a distance of 18 inches, and, beginning about 9 inches back of the point of the stem post, fasten with screws to the outside edges of the sides, and cut off flush with the back of stern.

The shell of the boat being finished, next in order will be bracing and stiffening, and providing it with seats and necessary rowing and steering apparatus. The keel should be pieced out to compensate for the curve in the bottom at the stern. This is done with 1-inch plank, cut out as shown in Fig. 1, and nailed for a good part of the way through to the main keel. It is further kept from twisting off by a brace of ⅞ or 1-inch half-round iron screwed to the stern piece, and into the end of the keel piece for the best part of its depth. The ends of this brace are forged with lugs turning outward, and holes punched through them to catch the rudder hooks. Figs. 1 and 4 show this construction.

For stiffening the bottom and sides, first lay two oak battings, 1 by 1½ inches, across the bottom, about 18 inches fore and aft of the middle. Lay these on their edges, and fasten from under side of bottom with 1½ inch screws. As shown in Figs. 1, 2 and 3, the sides are braced from these by oak knees cut from inch plank fastened from the outside.

Probably the most common and certainly the most dangerous error of amateur boat builders is that of getting the seats too high. Rowing seats should *not be higher* than 6 inches nor broader than 8 inches. For this boat make them of three-quarter stuff, supported at their ends by props resting on the bottom of the boat. Fig. 1 shows these in dotted lines, and they are also represented in Fig. 3. Never nail narrow seats to the sides, or to cleats fastened to the sides, as either of these methods unnecessarily mutilates the shell of the boat, and is sure to bulge the sides and cause a leak. The stern seat may be an inch higher than the rowing seats, as the load upon this seat is supposed to be more stationary. The stern seat may be about 20 inches broad, and a space about 10 inches wide, should be left between it and the stern piece for the reception of sponge, lock, etc.

As shown in the figures, the rowlocks are each rigged out about five inches; they are made of half-inch round iron, in two pieces, the first consisting of the rowlock brace, the ends of which are turned over the gunwale into the inside of the boat, each end being fastened by quarter-inch bolts, two inches apart, passing through the side boards. The ends and top of the brace are flattened, and to the top is riveted the rowlock proper. If swivel rowlocks are preferred, they may of course be dropped into holes in the top of the braces, instead of being riveted. The rowlocks should be placed at about the widest part of the boat, and after they have been put in, the proper position of the rower's seat may be determined, and a second seat put in position for a foot brace or stretcher. Use 8 or 8½ foot oars.

The method of making the rudder and tiller is sufficiently evident from Figs. 1 and 2. Regular rudder hooks may be purchased at a ship chandlery or hardware store. A

much cheaper contrivance is to simply screw two stout screw eyes, one above and the other below the lugs in the end of the keel brace, and for a pivot passing clear through all, a stout and snugly-fitting wire, with one end turned over to keep it from falling through. The rudder is thus enabled to swing freely, and is both supported and prevented from rising as the boat sinks.

All joints should be made in white lead, and all hardware galvanized, if obtainable. If galvanized screws cannot be procured, each one used should be first put into its place, then removed, and, after filling the hole with white lead, again "sent home."

Finish up the stem piece, leaving it from one-quarter to five-sixteenths of an inch wide at the point.

After completion, give the boat two or three coats of raw oil, allowing each a sufficient time to dry before applying the next. For the protection of the stem post and joints at the bow, it is advisable, though not absolutely necessary to cover them with a single piece of pliable galvanized sheet iron, as shown in Fig. 1.

If ordinary care be taken in making the nailed joints, there should be no occasion for caulking after they have had a fair chance to swell shut. If found necessary, however, it should be done with the greatest care, as a caulking tool of any description is apt to draw the nails and make a worse leak than before. Give your boat one *good* coat of *good* paint, and this, together with the oil, will be of more service than a half dozen poor ones.

The following estimate of cost is based upon present New York city prices:

77 feet half-inch white pine, planed both sides	$3.85
4 feet ⅜-inch, for seats, planed one side, and materials for stem and stern pieces	30
32 feet molding	38
Oak batting and knees, sawed out	25
Hardware	1.00
Pair oars, 8 feet	1.50
Forging outrigger, rowlock, stern stay-bolt, and keel brace	1.25
Paint, oil and white lead	1.10
Total	$9.63

THE

YOUNG SCIENTIST.

PUBLISHED MONTHLY.

TERMS—Fifty Cents per year. ☞ Postage free to all parts of the United States and Canada, except New York City. Our absurd postal laws make the charge for delivering our journal to subscribers in New York city five times as great as that required for transporting it across the continent, and delivering it to subscribers in San Francisco or New Orleans. We are therefore compelled to charge our New York subscribers 12 cents extra.

TO ADVERTISERS.

The YOUNG SCIENTIST has been received with so much favor that its circulation is already greater than that of any other monthly Scientific or Mechanical journal published in the city of New York, with the exception of the *Popular Science Monthly*. It goes into the best families, and has their confidence. NO CLAP-TRAP ADVERTISEMENTS, OR ADVERTISEMENTS OF PATENT MEDICINES RECEIVED AT ANY PRICE.

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All COMMUNICATIONS should be addressed to

THE YOUNG SCIENTIST,
P. O. Box 4875. 176 Broadway, New York.

☞ For Club Rates, etc., see PROSPECTUS.

Our Trial Trip.

IN offering four numbers for a trial trip for 15 cents, our object is to give to those who are interested an opportunity to examine the journal more fully than can be done by the inspection of a single number. Our rule is to send the four numbers at once, and the numbers that are sent vary from month to month, being always the last four that have been issued.

As it is inconvenient to keep book accounts of these small transactions, those who remit the remainder of the yearly subscription are requested to state what numbers have been previously sent.

The Study of Natural History.

THE study of natural history always has a special fascination for young people. Plants, insects, fishes, birds, all have peculiar charms, and when we come to know their names and something of their habits, they seem to us like familiar acquaintances

when we meet them in our walks. To those who have never made the acquaintance of these outdoor friends, a country walk is like the visit of a stranger to a large city. He knows no one, and although the store windows may attract him by their brilliancy, and the buildings please him by their magnificence, he loses that pleasure which is derived from intercourse with those we know and love. Those who have become familiar with plants and animals find friends and familiar acquaintances on every hand, and during their summer rambles are "never less alone than when alone."

In the study of botany and kindred sciences, it is the first step that is always the most difficult. Young people find it so difficult to make a beginning, especially when no teacher is at hand. We have, therefore, persuaded a well-known teacher of botany to give us a series of articles on "How to Begin the Study of Botany." These articles are not intended to teach *botany*, so much as to show young people how they must go to work to study this science; and it is assumed that those who wish to get the full advantage of these articles will study some simple text-book—such as "Gray's Lessons," "Wood's Text Book," or any other good elementary work. The first article will appear next month.

Exchanges.

WE have been asked to publish our rules in regard to exchanges—the time they are kept in, etc.

The general rules we publish at the head of the exchange columns. As we charge nothing for inserting exchanges, the time that they are kept in must depend upon our own convenience as to space, etc. Sometimes they are kept in for a long, sometimes for a short period. Our desire is to do everything we can for the convenience of our subscribers, but whenever we find occasion to omit the exchange list or any part thereof, we reserve the right to do so.

Of course those who wish to bring any particular subject before our readers with certainty and regularity, can avail themselves of our advertising columns; and notwithstanding our large circulation, we have placed the rates for such advertising so low that they are within the reach of all. Some who are not subscribers but who have seen the journal in libraries, or in the hands of friends, have sent in exchanges. To such we would say that the privileges of our exchange column are open only to those who are regularly entered on our books as subscribers. The amount of advertising that we *give* to our exchangers would cost them many times the subscription to the journal if they obtained it at usual rates. It is not, therefore, asking too much to request would-be exchangers to support the journal by their subscriptions.

Something Out of Nothing.

NOTWITHSTANDING the apparent absurdity of the thing, there is no bait more attractive to fools than the promise of a great deal for a very little, or even of something for nothing, and nowhere have more victims been found than amongst country people, who accept, without doubt, the promises of the man who offers a powder which will produce a pound of butter from milk which contains only an ounce of that article. The trick is an old one, and a very worthless one. The powder consists chiefly of alum and similar salts; these form a combination with the cheesy part of the milk, and change it so that it may be gathered into lumps resembling butter.

Every sample of milk contains just so much butter and no more, and the proportion which these powder sellers claim to attain is always greatly in excess of the amount contained in the very best milk. The product has, somewhat, the appearance of butter, but its flavor is bad, and it does not keep. Those who allow themselves to be deceived by such proposals are very apt to lose both their money and their milk.

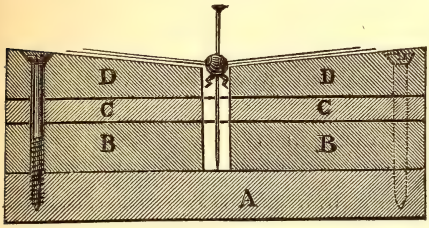
Laboratory & Workshop

Mounting Board for Entomologists.

The season has now opened for entomologists, and as there are, no doubt, among your subscribers, a large number of collectors of insects, I send you a drawing of a mounting board for butterflies and moths, which I have devised for my own use.

The advantages of using a mounting board for Lepidoptera are two-fold. The insects may be arranged in any desired position, and left until rigid, and they will stand at a uniform height on the pins in the cabinet.

The accompanying sketch is an end section, one-half full size, and it is very easily made, as follows: For the bottom, A, use a piece of hard wood, that the pins may only be pushed



MOUNTING BOARD FOR INSECTS.

against and not into it. The parts, B, C and D are made of pine or whitewood (not cedar), each piece being just twice the size represented in the engraving, and about 18 inches long. The top pieces are cut thin on the inside edges to give the wings of the insect a slight angle when set. For small insects and beetles the top pieces are left off, as they are of use only in setting the wings.

It is well to have several boards with the space for the bodies of different widths, as many of the moths have very stout bodies.

Between the pieces B, C and D, are laid thick paper or cardboard, through which, when in use, the pins are passed, and the whole screwed together with slim screws, three or four on a side.

When necessary new paper may be put in. As the pin can not enter the hard wood, the insects are sure to be set at a uniform height.

Any information concerning the killing or preserving of insects will be cheerfully furnished. F. C. SMITH.

Bridgeport, Conn.

Aquaria.

A writer in *Science Gossip* relates his experience with aquaria as follows: "I have kept a great number of aquaria, both salt and fresh water ones. I have often watched the sticklebacks, both salt and fresh water, and both sorts are very fond of attacking other fish, particularly the fresh water species. The latter attacked goldfish, roach, dace, minnows, and other kinds of fish, as well as newts and tritons. They nibble the tails and fins off the fish, particularly the goldfish, and the fish get diseased through it, and pine away and die. I have lost a great many goldfish by their depredations. They nibble or bite the toes and tail off the newts: I have seen their tails bitten so frequently by them that there has been very little left of them. I should never advise any one to place them in a nice-stocked aquarium, and they should be kept out of small ornamental ponds where there are goldfish. If you wish to see how destructive they are, place some of those fish or animals that I have mentioned in an aquarium by themselves; you will then see that the sticklebacks will not let them rest a minute; they will worry the poor fish to death."

A House Fired by a Milk Can.

One of our exchanges quotes the following: "At Aurora, Illinois, a few days ago, a milkman left a milk can turned bottom upwards on a table near his house in such a way that it reflected the rays of the sun on a window after the manner of a burning glass. The blind caught fire from the heat, and, but for the timely discovery of the flames, the house would have been consumed."

And then asks, "Can this be?" Certainly; nothing more simple. The bottom of the can was probably made concave, so as to be strong, and the dairy maid was probably very neat and cleanly, and made it shine as brightly as newly planished metal. Under such circumstances the concave bottom would act like a burning mirror, and if at exactly the right distance from the blinds, would readily set them on fire when the sun shone bright.

Lichen Ornaments.

A lady in Mississippi, writing to the "Household," says: "I have a cross, a wreath and a small basket for the mantel, made of them. Cut the pasteboard the desired shape, and tack the lichens

on, overlapping them so as to conceal the stitches, and varnish. I think bright bits of wool, or small beads, very small leaves, sprigs of moss tacked about in the interstices, improves them, and make them resemble shell-work more. Those who live in the country can easily procure the lichens from old logs, stumps and rails. They should be gathered before very cold weather, as I think they are injured by it."

What will the Weather Be?—The agricultural editor of the New York "Sun" has carefully tested the so-called "Signal Service Barometers," and the following is the result at which he arrives: "The so-called 'storm glasses,' usually made of a solution of gum camphor in pure spirits, are really of no value whatever in indicating the weather in advance. We have one of the best in the market, and, after watching it closely for the past year, have come to the conclusion that it is utterly worthless for the purpose intended."

Inquiries and Answers.

Inquiries.

22. Will you please tell me how to burn iron or platina wire so that it will light gas? **

23. Please publish a recipe for mending common white tableware. I have tried gum shellac, but it does not answer the purpose; it was the only kind of shellac I could obtain, and I tried it according to your directions in your article on cements.
J. G. J.

24. In your April number, you told how to make a lamp out of an ink bottle. Will you tell me what oil to use. I tried it with alcohol, and it burned very well. —

25. What are the chemicals used in preserving flowers? E. VON A.

26. Will some one please tell me how to make cloth waterproof, so that I can use it for a canvas boat, and still be pliable, so I can take it off and roll it up. 000.

27. What is the simplest method of making a cheap electrical machine that will charge a Leyden jar? W.

28. Will some reader give a cheap and easily applied silver-plating fluid? F. L. T.

EXCHANGES.

In this column yearly subscribers who may wish to *exchange* tools, apparatus, books, or the products of their skill, can state what they have to offer and what they want, *without charge*. Buying and selling must, of course, be carried on in the advertising columns.

Wanted, telegraphic and mathematical instruments; Pitman's Phonography in exchange; also thorough instruction in same by mail. F. S. P., King's River, Fresno County, Cal.

Cigar machine to exchange for bracket saw or good microscope. Leonard Alexander, Linneus, Me.

Wanted, microscope, or scientific and mechanical books and apparatus, in exchange for printing press, cost $21, with or without type and material. J. P. Burbank, Salem, Mass.

Wanted, microscope; new Tillotson relay and part cash given in exchange. W. O. F., 83 Downing street, Brooklyn.

To exchange, a Kidder electric battery, for a private line telegraph instrument. Charles L. Feldkamp, 200 W. Randolph street, Chicago, Ills.

Wanted, complete Lester combination scroll saw in good condition; books in exchange. J. T. Jackson, Box 48, Metuchen, N. J.

First-class scroll saw, double treadle, all improvements, worth $40, for second-hand Tolles' objective, not higher than 1-5. John D. White, Chicopee, Mass.

Camera for taking portraits wanted; state what is wanted in exchange. J. F. H., care of this journal.

Wanted, second-hand dictionary, and book on shorthand; state what is wanted in exchange. P. J. Murry, Box 783, Wilkes Barre, Pa.

Wanted, spring motor to run four sewing machines. Barton A. Whitsett, Box 115, Lebanon, Ind.

Gold watch (cost $150) in exchange for a good microscope. E. W., Box 4875, New York.

A work on painting and wood finishing, value $1.50, to exchange for scroll saw patterns. R. F. Hanscam, North Barnstead, N. H.

A good telegraph instrument, cost $7 50, for a couple of good books on chemistry, electricity, etc. H. B. Kinney, Hamlin, Brown County, Kansas.

A large number of minerals and fossils for exchange. Persons wishing to exchange please send list to W. H. Hughes, 47 Jeff. Avenue, Grand Rapids, Mich.

Wanted in exchange for a second-hand scroll saw, treadle power and wooden frame, a good Excelsior microscope, or live box. Jos. G. Thorp, 54 West Seventeenth street, New York.

A set of chemicals and apparatus; also a set of wood engraver's tools, glass and instruction book, to exchange for a scroll saw and a microscope. The chemicals and tools cost nearly $40; will give a good trade. F. H. Jackson, Angelica, N. Y.

To exchange, a Pope's air pistol for a set of carving tools. L. Y. R. G., Box 317, Brookfield, Mass.

Wanted, a small turning lathe in exchange for a pair of telephones. J. C., care YOUNG SCIENTIST.

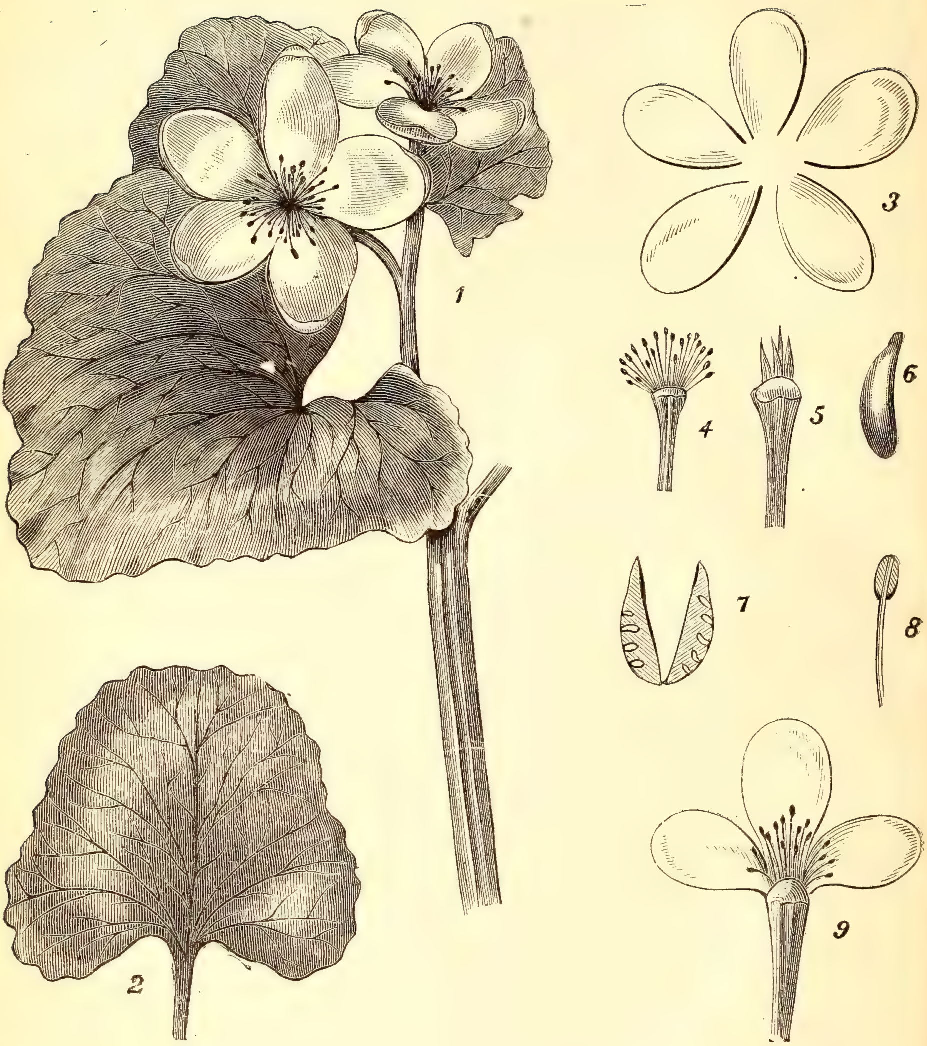
Scroll saw wanted in exchange for handsome portfolio of six water color sketches. Address F. S., care Box 4875, New York.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. H. A. Cutting, State Geologist, Lunenburgh, Essex County, Vt.

Thorough and practical instruction in shorthand will be given in exchange for a microscope, with or without accessories, worth from $5 to $10. Address T. P. Wendover, 68 Christopher street, New York.

Wanted, a small turning lathe, about 1½ inch swing, and 12-inch bed; must be well made; books and apparatus in exchange. R. M., care of this journal.

Wanted, a copy of Holtzapfel's "Mechanical Manipulation." State what is wanted in exchange. E. W., Box 4875, New York.



HOW TO STUDY BOTANY.

1. Caltha Palustris. 2. Single leaf of do. 3. Calyx of do. 4. Stamens of do. 5. Pistils of do. 6. Pistil. 7. Section of Pistil. 8. Stamen. 9. Vertical Section of the flower.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A Popular Record of Scientific Experiments, Inventions and Progress

VOL. I. NEW YORK, JULY, 1878. No. 7.

How to Begin the Study of Botany.

ON a pleasant day in Spring, I gathered my pupils together; dressed to defy any possible dampness, our feet protected with india-rubbers, that no marshy land might deter us from examining its plants, and laden with our botanical boxes, we started for a ramble in the fields. One enviable boy exhibited a pair of rubber boots, the penalty for which was commissions from his companions to get for them any flowers which might grow in water beyond their reach, all of which he very pleasantly accepted.

Let me describe my class; it numbered six pupils. Hal, the eldest, a bright boy of fourteen, and the owner of the boots; then Lucy, Amy, Ned, Mary and Charlie, who, being our youngest, eight years old, was put under the special care of Hal, by whom he was regarded quite paternally. The children were full of interest for their new study, and in their eagerness would sometimes speak together, so that I was obliged to remind them that I could neither hear nor answer all at once.

Hal walked with me, and the little procession followed, sometimes walking quietly, like grown people, and then one, espying some flower, would dash off, and the others after him. When they had again assumed a quiet demeanor, after one of these sorties, I called their attention to the trees which surrounded us, and bade them notice their different shapes. Approaching an elm, they first noticed its plume-like appearance, and on a nearer approach, observed that the boughs, which, springing from nearly the same point on the trunk, sometimes near the ground, diverged gradually and equally till the normal height of the tree was attained, and, becoming slender, bent downwards in graceful curves, and the branches and branchlets followed this arched arrangement. They passed a group of oaks, and, singling out an individual tree, contrasted its crooked, lon

outstretched arms, and its massiveness, with the curving grace of the elm. Lucy noticed there were dry leaves on it. "These," said I, "are the leaves of last season, and have remained all winter, so we call them persistent; but they will soon be replaced by fresh ones. The beech also has persistent leaves. Pines and firs keep their leaves, but these are called evergreen, because they do not change their color."

Here Amy, who had drawn near, observed that she had seen the ground beneath pines strewn with their sweet brown needles, and asked when pines had new leaves. I answered that the leaves of pines remained for two or more years, but that the fall of their old leaves and the growth of new ones were gradual, so that the tree was never bare.

"See that crooked stem," said Charlie, "it has twined about that bush by its side. What is it?"

"That," I answered, "is a grapevine, and in tropical countries, vines of various kinds become so thick and strong, they form an almost impenetrable tangle in the forests."

We were now approaching the brook, which, swollen by the recent rains, loudly murmured in its stony bed.

"Hal! Hal!" from many voices, "there are some beautiful yellow flowers in the brook. Please get them for us?"

Hal bravely stepped in, and brought back a cluster of March marigolds, fresh and glistening, from the water. The children crowded about me, to hear what I could tell them about the flowers, but I proposed that they should ramble about, and get what other flowers they could, and then we would find some dry seats under the oaks, and examine our treasures. This we did, and presently, with well-filled boxes, gathered under one of the venerable oaks.

"Let us look first at the marigold," (Fig. 1) said I, and taking up a specimen, and bidding each to take one, we began to examine it. "The botanical name of your flower is *Caltha palustris;* look now at the whole plant, as you did before at the tree; it has, like every other plant, its own individual look, and that we call the *facies* of the plant. Look at it more closely; it has a stiff, round stem, furrowed, bearing two or three leaves, and one to three smaller stems, each terminated by a flower; the leaf has a broad rounded form, (Fig. 2) or is kidney shaped; it is a simple leaf, with the margin beautifully scolloped. The lower leaves are on short stems—petioles—but the upper one has a very short petiole, and is almost sessile, which word means to be directly inserted upon the receptacle."

Here Amy, who had been turning the flower about in her fingers, exclaimed, "Why, where is the calyx?"

"What makes you think there is no calyx?" said I.

"I thought the calyx was always green," answered she, "but these petals are yellow."

"Sometimes," I answered, "the calyx is delicate and beautifully colored, like a corolla. This is the case with the *Caltha;* its golden cup is made up of sepals, of which there are five (Fig. 3), and there are no petals; the sepals are parts of the calyx, and the petals parts of the corolla. Remove the sepals, and you will see many stamens (Fig. 4), and these plucked off, you will see in their midst several pistils." (Fig. 5).

Here, with the point of my knife, I cut out a stamen (Fig. 8) and pistil (Fig. 6) from the flower cup, and, placing my magnifying glass before them, exhibited them to the children. Again using my knife, I cut a pistil through vertically (Fig. 7), that its internal structure might be seen. Having passed it about the circle of children, I explained that these little bodies which they saw within it were ovules which would ripen into seeds; the part of the pistil which contained them was called the ovary, and its cavity a cell. This ovary was one-celled.

"Do you think of any flower this *Caltha* resembles?" I inquired.

"Yes," spoke up Mary, "it looks like a buttercup."

"It belongs," said I, "to the same family, and the flowers of this family, though showing great diversity of form, are united

by this characteristic; all their parts are separate, and on the receptacle."

Here, taking a flower, I pulled off its different parts, sepals, stamens and pistils, and showed the children that they were entirely distinct and unconnected with each other, and cutting through a flower vertically (Fig. 9), they noticed that all the parts were on the receptacle, which I now told them was the top of the flower stalk or peduncle.

"Let us look at the other flowers you have."

The boxes were opened, and their collections comprised dog-toothed violets, wood violets, columbines, saxifrage, antennaria (which the children called pussies), houstonia, anemones, and a flower about which a dispute arose, some saying it was an anemone, but others, observing a difference, said it was not an anemone. Charlie had gathered chickweed, on which the others looked scornfully, it was so small and common, they said. Observing the little fellow's face fall, I told him he was quite right to pick it, for no matter how small or common a flower was, it was just as good to examine as a larger or rarer flower. Thus encouraged, he brightened up, and produced some dandelions.

"Let us," said I, "now collect our flowers and return home. To-morrow we will meet at my house, and examine them."

This was done, and my little party turned homewards, tired but happy.

To be continued.

How to Study Entomology.

BY F. C. SMITH.

II.

Continued from page 75.

AS many of the rare moths fly only by night, the collector who will take his lantern and search the fields, and especially the woods, will be amply rewarded by finding specimens that are seldom seen by daylight.

Sugaring.—Moths are attracted by sweets and dazzled by bright lights. We may form artificial feeding grounds for them by smearing trees, fences, stumps, stones, etc., with a mixture of sugar, treacle, or coarse molasses, and beer. Equal weights of treacle and the cheapest brown sugar, boiled to the consistency of very thick molasses, will make a good preparation for sugaring. Just before using, a very little rum may be added, to intoxicate specimens that may come to feed.

The ground should be chosen beforehand, and toward nightfall, the places selected smeared with the preparation. It is not necessary to use a large quantity, a little brushed on with an old brush or rag being sufficient. The locality selected may be in an open field, but the edge of a piece of woods is preferable. Several places may be worked at the same time, each being visited in rotation. A bulls-eye is more convenient and effective than an ordinary lantern. If a common lantern is used, a reflector should be placed behind the light to intensify it as much as possible. A bulls-eye, being smaller, may be attached to the waist by a band or strap, throwing the light forward and yourself in the dark. The net, ether, and collecting box, described last month, should be taken, and the insects captured in the ordinary manner.

Should the collector possess unusual luck, and not wish to be hindered by pinning the

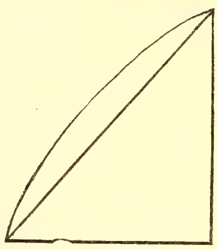


Fig. 1.

specimens as they are captured, it will be found very convenient to have some small paper pockets made by cutting off the corners of old envelopes in the shape shown in the engraving.

The same resorts may be worked through the season, as they will soon become the

popular and favorite meeting places of valuable specimens.

Trap for Moths.—An old tea chest or grocer's box forms the basis of a good trap. By reference to the figure the construction

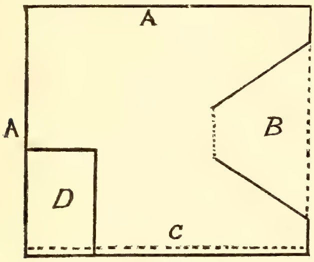


Fig. 2.

is easily understood, and it may be made by any boy. The box, A A, has a circular hole cut in one side, and a coarse canvas or wire gauze funnel fastened in at B. The bottom may be covered with the sugar and treacle described above, and this covered with gauze or canvas, C. A small door at D, with leather hinges, and fastened with a button, will be convenient for taking out specimens. This trap, when set in a field at night, will often contain next morning a large number of beauties.

Sweeping.—For securing a variety of small moths, flies, beetles, etc., the process called sweeping is very successful. The net is here used by walking through a field of grass or stubble, and constantly sweeping it back and forth in a half circle ahead of the collector, the net just clearing the ground. An infinite variety of insects will be obtained by this method, out of which select those cared for, and confine in small pill boxes or envelope corners.

Setting Small Insects.—Insects that are too small or too delicate to be pinned, are easily mounted on cardboard or very stiff white paper. A sheet of cardboard may be covered with specimens, and when full cut into squares, each square containing an insect. Thick gum arabic water, with a very little corrosive sublimate (poison) added, makes a good gum for fastening the specimens to the cardboard. A spot about the size of the insect should be gummed, the specimen placed on this, the legs adjusted and then allowed to dry.

Remember to keep the record of all collections, with date, locality, number, etc.

Larva.—The collector will often find worms, grubs and caterpillars; these are the larvæ of future moths and butterflies, and should be saved, especially those that are found feeding. A few of the leaves they are feeding upon should be taken, with which to feed them until they spin. The large green worms found on fennel, tobacco, parsley, carrot tops, elm and mulberry trees, are valuable, and much amusement and instruction will be derived by watching them during their transformations. They may be put in paper boxes, with their food, and most of them will spin, though some species will bury themselves in the ground, and enter the pupa state without forming a cocoon. For this reason it is advisable to put a little earth in each of the boxes, and when the larva is inclined to dig, transfer it to a jar or tin fruit can nearly filled with earth. All larvæ should be kept in a warm place, which will hasten their transformations.

To be continued.

Simple Lessons in the Art of Photography.

COLLODION.

COLLODION is a solution of gun-cotton in sulphuric ether and alcohol. Cotton consists chemically of carbon, hydrogen and oxygen; gun-cotton contains an additional element, namely, nitrogen, which renders it explosive. Photographic gun-cotton, that is, the gun-cotton used in photography, is not so explosive as gun-cotton used for military purposes, but it is perfectly soluble in a mixture of ether and alcohol. The technical name for gun-cotton in photography is *Pyroxyline.*

Cotton or filtering paper is transformed into pyroxyline by immersion into a mixture of nitric and sulphuric acid. Only the finest cotton or the best Swedish filtering

paper should be used. It is first freed from all resinous and fatty matter by boiling it in a two per cent solution of carbonate of potassa for a few hours. The cotton is then taken out, washed in several clean waters, and finally left to soak in clean water for twenty hours. All superfluous water is pressed out, and the cotton is dried either by artificial heat or in the sun.

Any vessel of glass or porcelain, large enough for the quantity of gun-cotton to be prepared, can be used. For half an ounce of cotton take 12 ounces commercial sulphuric acid, which is first poured into the vessel; next add gradually, constantly stirring with a glass rod, three ounces water, and finally pour in four ounces commercial nitric acid. The mixture is well stirred before the cotton is introduced in small portions, and left in the acid for from eight to ten minutes. The cotton is moved about in the fluid with a glass rod to prevent unequal action of the acid. The acids should, by means of a water bath, be kept at a temperature of 150° Fahrenheit. At the expiration of the prescribed time the cotton is removed, with glass rods, out of the acid, and then washed in several clean waters, till it shows no acid reaction on litmus paper. It can be dried by hot air below 120°, and has to be preserved in an air-tight box, well protected against light and moisture. Cotton is thus transformed into pyroxyline, filtering paper into papyroxyline.

The best solvents of pyroxyline are sulphuric ether and alcohol, generally taken in equal proportions. The ether should be chemically pure, and the alcohol at least 95 per cent. A want of ether in the collodion sometimes causes the film to peel from the glass after it has been taken from the silver bath. Excess of ether will sometimes result in a species of unevenness called curtains. When the collodion contains too much alcohol, the fact is sometimes betrayed by its containing "nobs," that is, small lumps of undissolved collodion. Poor alcohol will produce crossnetting in the film, namely, a kind of network extending over the whole surface. A little ether added to the collodion sometimes cures the evil. Such plain collodion is sensitized by the iodides and bromides of different metals. Iodides produce vigor and brilliancy in the negative, while bromides soften and harmonize great contrasts, and show greater sensitiveness for middle tints. In the preparation of collodion for special purposes, these characteristics of the sensitizer should decide the selection of the formula.

The iodides of cadmium glutinize collodion, whereas an alkaline iodide liquefies it. The iodides and bromides most generally employed are those of lithium, potassium, sodium, ammonium and cadmium.

We here give some of the best formulæ for bromo-iodized collodion:

1. For Negatives—Alcohol, 95 per cent, 4 ounces; ether, concentrated, 4 ounces; iodide ammonium, 16 grains; iodide cadmium, 8 grains; bromide cadmium, 16 grains; pyroxyline, 48 grains.

2. For Positives—Alcohol, 4 ounces; ether, 4 ounces; pyroxyline, 32 grains; iodide ammonium, 24 grains; bromide cadmium, 16 grains; 4 drops of tincture of iodine.

The preparation of bromo-iodized collodion is conducted in the following manner: Measure off the alcohol and dissolve in it the iodides and bromides, and let this solution stand at least one hour, the longer the better. Add now the cotton in small flocks, and finally pour in the ether. The bottle containing all the ingredients should now be thoroughly shaken, and is then set aside for two or more days to ripen and settle. The clear portion can be decanted into another clean bottle, and is ready for use. If a test with litmus paper should prove the collodion to be alkaline, a few drops of the tincture of iodine can be added.

The bromo-iodized collodion is preserved in full bottles, well corked, in a dark place and cool temperature. It will keep for about a year. Collodion prepared by the above formulæ will ripen in one or two days, and keep eight or twelve months. Collodion prepared only with cadmium can

be considered stable, but its ripening process will extend over weeks instead of days. Exposing the freshly prepared collodion to the sun shortens the ripening process, without detriment to its other qualities.

For pouring bottles, use bottles with projecting lips, and cover the cork and neck of the bottle with a cap, either of glass or varnished pasteboard.

How to Study Science.

THE method of study is also important, and just here is where many otherwise good institutions fail. Every student of nature should meet nature at first hand, and learn to observe her phenomena for himself. Lectures and text books are but minor accessories to study; in the sciences they play a wholly subordinate part; in the laboratory, the field, and the museum, the chief work is to be done. No matter what branch of science is to be pursued, the student from the very first must meet it face to face. The biological sciences ought to be studied in the field, collecting; in the museum, classifying; in the laboratory, with the microscope and the scalpel. Far too often is the study of natural history degraded into a mere memorizing of classifications; as if the transitory part of science were more valuable than the permanent. The student must see, handle, dissect, and investigate for himself. He is to study the phenomena of life, and not merely the external appearance of a lot of stuffed specimens. Chemistry, and physics also, are to be studied chiefly in the laboratory. It is not enough for a student to see experiments, he must himself perform them. Thus only can he learn the true scope of these great sciences. By a proper drill in qualitative analysis, he learns to observe closely, and to reason from his facts to their interpretation. Quantitative analysis gives him accuracy of manipulation, and an insight into the absolute value of experiment. This insight also results from delicate practice with instruments of precision in physics; a kind of exercise of the very highest educational value. If the course of study in any science can be capped by an original research leading to the discovery of new facts, so much the better. In a German university the candidate for a doctoral degree in science is absolutely required to carry out such research, and to submit a dissertation upon it. This is not a severe requirement—every student who has been decently trained is able to come up to it, all the popular notions about the mysteriousness of scientific research to the contrary notwithstanding. Why should we not aim to equal the German standard?—*Popular Science Monthly.*

Microscopy.

How to Make an Aquarium of Microscopic Objects.

TAKE with you a small tin pail down to the seaside, and fill it full of pure salt water. Walk along on the sunny side of some creek or inlet, until you come to a spot where eel-grass or sea-weed is growing luxuriantly. Place your pail of water down beside you, and in it wash carefully a quantity of the eel-grass or sea-weed. Repeat this operation several times at different places, being careful not to soil the water with mud. Now put into your pail a pebble with a choice bit of sea-weed attached to it, and you have all the material necessary for your aquarium. Take it home, and pour the water into a small glass phial, drop carefully into it the stone with the seaseed growing upon it; then, after covering the mouth of the bottle with muslin to exclude dust, place it in a sunny window, and in a few weeks you will be astonished at the result. The sea-weed will have shot out little delicate branches through the water, which will remain perfectly pure and transparent for months, while every drop of it will contain many living objects of different varieties that will increase and multiply to a wonderful extent, and will be ready at all times to be admired under the microscope.

As the water in the phial evaporates, it

will be necessary to add fresh to it. By adding salt water, it is evident the whole would soon become too salt to sustain life.

S.

The Hydra.

THIS fresh water polype is not exactly a microscopic or a very minute object. It is plainly visible to the naked eye when extended, and its beauty will amply pay an examination. Hydras may be found attached to leaves or sticks, during warm weather, in almost any pond. In the aquarium they attach themselves to the side turned towards the light, or to *Anacharis alsinastrum* and to the *Valisneria spiralis.* The hydra can assume a variety of forms; it may appear vermiform (or like a worm), it may attenuate its body and its tentacles so much as to become almost invisible, or it may contract suddenly and show only as a speck of jelly. The tentacles are prehensile organs round a central cavity, and are also used for locomotion. These thread-like organs wind themselves round their prey like a lasso, and completely paralyze it. By gradual curving, the object is brought to the mouth and engulphed there, while any refuse or any undigested parts are rejected from the same opening. Like all the polypes and other low organizations, hydras can rapidly reproduce any part of their body; they may be cut into pieces or divided into halves, and each piece will go on performing the functions of the animal, and will be complete again in a very few hours. One hydra may swallow another without injury to either, or it may be turned inside out without any detriment to its vital functions. Their usual size, when full grown, is about three-quarters of an inch, and the red hydra (*hydra rubra*) is more easily seen in an aquarium than the other kinds. These singular beings are very voracious. They can swallow a worm, a cypris, or a cyclops, of twice their own size. Hydras multiply very rapidly; a portion of their body swells or buds out. and a young one presently appears, remains attached to the mother for several days, when it floats off; or they throw out eggs at one time, and living young ones at another. Hydras appear to be long lived; I have a hydra in my aquarium which I collected ten years ago near Greenwood. *

The Aquarium.

THE secret of success in Aquarium management is to sustain the proper balance between animal and vegetable life, thereby securing purity of the water without change, with consequent life and health to the inhabitants; the aquarium must in fact be a miniature pond. Oxygen is animal life, this plants give off. Carbonic acid is death to animals, this plants absorb—but plants need sunlight to perform their office to perfection.

Eighty-eight years ago, Sir John Dalyell began aquarium keeping. Three times a week his servants trudged two miles to the sea-shore to fill a four-gallon jar with sea water. Sixty-one years this routine was kept up. His specimens were of the orders lower than fishes, his receptacles cylindrical jars holding one animal each. The water was changed daily—oftener if the slightest sediment was to be seen.

In 1842, the first true aquarium principles were recorded. Dr. Ward, recognizing the mutual dependence of the animal and vegetable kingdoms, arranged them together in water. Mrs. Annie Thynne followed with the same ideas some four years later.

The marine aquarium presents attractions the fresh water cannot afford—but the fresh water affords attractions sufficient to interest the novice. The care of the latter is less. In case of accident it can be sooner renewed or replaced. It is easier to begin with and is more easily kept in order. The fresh water should precede the marine aquarium.

The brooks, creeks and ponds will afford the furnishing, whether of animal or vegetable life, and the study of the life beneath the waters, if one may obtain their own specimens, will add new interest to it all. The aquarium to the young will afford lessons that cannot be gained from books; lessons upon Nature's immutable laws. Artificial law may often be evaded with impunity, but natural laws never. The penalty inevitably follows, and that penalty is oftenest death. The study of the aquarium will favor the development of thought and inquiry, and the observations will become almost personal experience.—*Ex.*

THE

YOUNG SCIENTIST.

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As it is inconvenient to keep book accounts of these small transactions, those who remit the remainder of the yearly subscription are requested to state what numbers have been previously sent.

Contributions for the Young Scientist.

WE have been offered lately, by title, quite a large number of articles for this journal, many of which, if as good as their authors think they could make them, would be quite acceptable to our readers. Others, however, are of such a character as would not tend to advance the aims we have in view. To save trouble and unnecessary correspondence, we would say to those who think that they can furnish something of interest to our readers, that the only way to obtain a decision is to send on the articles themselves.

It is much more easy to say what we do *not* want than to describe an acceptable article. We do not want mere literary articles; even historical articles are out of place. All essays on the beauties and value of science go at once to the waste basket. What we want is *practical* articles, telling how to *do* something. If you have made some useful article by a new method, or of new materials; if you have devised some new process or wrinkle, or some new way of doing an old one, send us an account of it, and it will no doubt be acceptable. But we must see it before we can decide, and to receive our attention at all, the article must be thoroughly practical.

To Our Exchangers.

VERY many of our exchangers seem to overlook the conditions upon which exchanges are inserted. As the space now occupied is nearly as much as we can afford, we have determined hereafter to limit the exchange department to a column and a half; new exchanges will be placed at the beginning, and the old ones will be dropped as fast as they are crowded off at the other end. All exchanges will be limited to thirty words, and all attempts at buying and selling will be rigorously excluded.

Fourth of July Pistols.

THE love of firearms which exists in the minds of most boys is undoubtedly an inherited remnant of that instinct which leads most savage races to be hunters. Almost every boy is born a hunter. Set a wild animal, such as a rabbit or a woodchuck, before a crowd of school boys, and see how they will go for it! This instinct leads the boy to clamor for a gun or a pistol as soon as he has donned his first pair of pants. Unfortunately his request is gener-

ally refused, until the universal noise-making of the Fourth of July comes to reinforce his demands, and notwithstanding all that has been said or written about the dangers of pistols or cannons, every Fourth brings an enormous number of serious and fatal accidents.

Now, if instead of endeavoring to *stifle* the fondness for firearms, parents and guardians would endeavor to *guide* the taste of boys in this direction, it would be much more sensible. The boy who is in the habit of using firearms for sport or for marksmanship will never degrade them to the mere purpose of making a noise. By most persons, however, the most dangerous and foolish course is in general pursued toward the lad who shows an inclination to use the gun, particularly if his guardian be not himself a sportsman. When a boy first asks permission to use a gun, it will be found that most old women (whether they wear petticoats or not) forbid the use of what they consider such a dangerous weapon, but are willing that he should have a *pistol*,—which is a far more dangerous plaything, both for the boy himself and for those who are about him. The long barrel of a gun is not readily pointed either in the direction of ourselves or others, without our knowing it; while the shorter pistol frequently comes into dangerous range either of the person who holds it or of others, without being immediately perceived. Moreover, a boy in such circumstances receives no proper instruction in the handling, loading, carrying, and discharging of a gun, when by his own stealth or the carelessness of his guardians, he comes into possession of one. Those rules, which, from long habit, have become second nature to all good sportsmen, are unknown to him, and of course unacted upon. He carries his gun with the hammers on the caps, and with the muzzle pointing downward or horizontally toward every point of the compass. He pokes the muzzle through any fence he may have to cross, gets through or over himself as best he can, and then drags the gun after him, frequently receiving the contents of one of the barrels while so doing. In short, his gun, instead of being an instrument of honest recreation, becomes the source of stolen sprees, and is sooner or later a cause of serious accident. Sensible guardians ought to abandon all this. If a young man shows an inclination for the sports of the field, let them see that he is provided with a safe and efficient weapon, and carefully instructed in its use. Youth must have recreation, and it is better for a young man that he should devote his days to the green fields than his nights to the green table.

Laboratory & Workshop

New Photographic Process for Copying Drawings.

The following is a convenient method for reproducing drawings, plans, maps, and line engravings in general. The paper is first prepared by dipping it in a bath composed as follows: Distilled water, 10 ounces; perchloride of iron, 1 ounce; oxalic acid, 4 drachms.

When dry, the paper, if protected from light, can be kept as long as may be necessary. To copy a drawing, the model, on oiled or transparent paper, is applied on some paper thus prepared, and the whole exposed to light in an ordinary photographic printing press. In summer and in the sunlight, an exposure of from fifteen to thirty seconds is sufficient; in winter, forty to seventy seconds; in the shade, during clear weather, from two to six minutes; and, lastly, when the weather is overcast, cloudy, rainy or snowy, from fifteen to forty minutes are necessary.

The paper, on being withdrawn from the press, is placed in a bath containing from fifteen to eighteen per cent of ferrocyanide of potassium. It is then washed in an abundance of water, passed in a bath containing eight or ten per cent of muriatic acid, washed again, and dried.

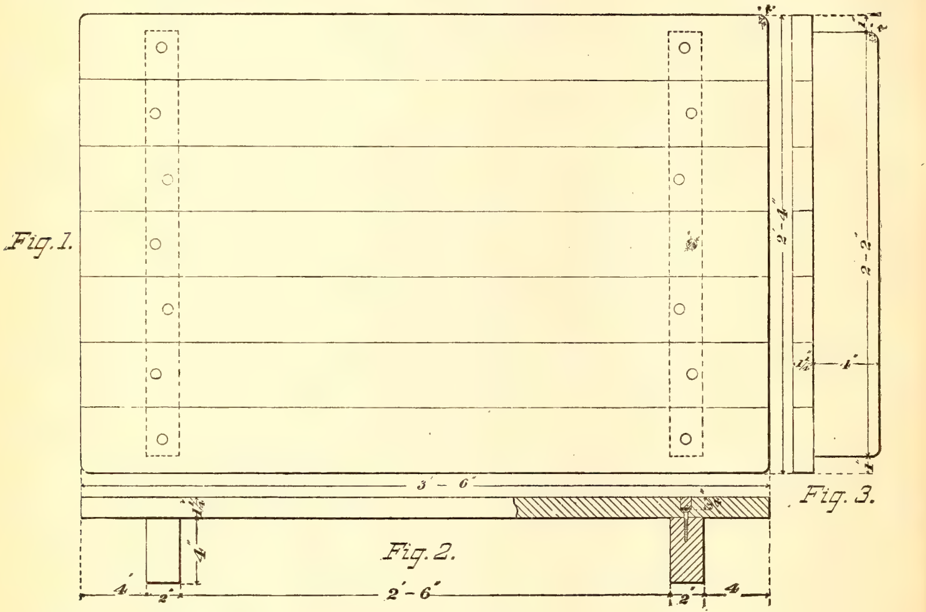
The explanation of the operation is as follows: The perchloride of iron, under the influence of light, is reduced by oxalic acid to the state of protochloride, which is soluble in a solution of ferrocyanide of potassium, while

the same potassium salt transforms the perchloride into the insoluble cyanide, well known under the name of Prussian blue. As the black lines of the engraving to be reproduced protect the prepared paper from the action of the sun, the perchloride remains unchanged in such places, and the drawing appears in the copy in sharp lines of a dark blue color on a white ground. The advantage of the process is that a positive picture is obtained immediately.

How to Make a Drawing Board that will not Warp.

The two sizes of drawing paper most commonly used by engineers and architects are "Double Elephant" and "Imperial." These are the most convenient sizes, and drawing boards made to suit them admit of the use of other and smaller sheets of paper. A drawing board large enough to take "Double Elephant" paper, which in size is 40 by 26 inches, should be 42 by 28 inches, and this will allow the use of all sheets of drawing paper of sizes within these dimensions, as "Atlas," "Columbier," "Elephant," "Imperial," "Super Royal," "Royal," "Medium," and "Demy."

A great many of the drawing boards kept for sale amongst artist's materials are made without reference to the sizes of drawing paper or their suitability for the T square. Most draughtsmen prefer to have drawing boards made of proper dimensions, and in a way that will keep them from warping. The following is a very excellent plan for the construction of a drawing board. The dimensions are given for a size to suit "Double Elephant" paper. It will be observed by the accompanying drawing that the board is made in seven pieces, each 4 inches wide and 1¼ inches thick, jointed together by square joints with glue only, but without tongueing and grooving. On the back are two strong cleats, 4 by 2 inches, set on edge near the ends of the board, and secured by screws from the face of the board, the heads of which must be sunk deep enough to avoid the points of the drawing pins. The holes made for countersinking the screws must be plugged up with wood glued in, the grain of which should run parallel with that of the board. The manner of doing this is plainly shown by the section, Fig. 2. The four corners of the board and lower corners of the cleats should be slightly rounded, so as to



DRAWING BOARD.

avoid the liability to splinter in handling. The material best adapted for this, and all drawing boards is well seasoned, clear, soft white pine.

It is often convenient to have a drawer attached to the drawing board. This may be attained by putting hard wood battens or runners about 2 inches deep on the inside of the lower edges of the cleats.

The construction of this kind of drawing board will be readily understood by reference to the drawing, and will be found preferable to all others.

Veneering.

The softest woods should be chosen for veneering upon. Hard wood can be veneered—boxwood with ivory, for instance; but wood that will warp and twist, such as cross-grained mahogany, must be avoided.

The veneer, and the wood on which it is to be laid, must both be carefully prepared, the former by taking out all marks of the saw on both sides with a fine toothing plane, the latter with a coarser toothing plane. If the veneer happens to be broken in doing this, it may be repaired at once with a bit of stiff paper glued upon it on the upper side. The veneer should be cut rather larger than the surface to be covered; if much twisted, it may be damped and placed under a board and weight overnight. This saves much trouble; but with veneers that are cheap it is not worth while taking much trouble about refractory pieces. The wood to be veneered must now be sized with thin glue; the ordinary glue-pot will supply this by dipping the brush first into the glue, then into the boiling water in the outer vessel. This size must be allowed to dry before the veneer is laid.

We will suppose now that the veneering process is about to commence. The glue in good condition, and boiling hot, the bench cleared, a basin of hot water with the veneering hammer and a sponge in it, a cloth or two, and everything in such position that one will not interfere with or be in the way of another.

First, damp with hot water that side of the veneer which is not to be glued, then glue the other side. Second, go over, as quickly as possible, the wood itself, previously toothed and sized. Third, bring the veneer rapidly to it, pressing it down with the outspread hands, and taking care that the edges of the veneer overlap a little all round. Fourth, grasp the veneering hammer close to the pane (shaking off the hot water from it) and the handle pointing away from you; wriggle it about, pressing it down stoutly, and squeezing the glue from the centre out at the edges. If it is a large piece of stuff which is to be veneered, the assistance of a hot iron will be wanted to make the glue liquid again after it has set; but don't let it dry the wood underneath it, or it will burn the glue and scorch the veneer, and ruin the work. Fifth, having got out all the glue possible, search the surface for blisters, which will at once be betrayed by the sound they give when tapped with the handle of the hammer; the hot iron (or the inner vessel of the glue-pot itself, which often answers the purpose) must be applied, and the process with the hammer repeated.

When the hammer is not in the hand, it should be in the hot water. The whole may now be sponged over with hot water, and wiped as dry as can be. And observe, throughout the above process, never have any slop and wet about the work that you can avoid. Whenever you use the sponge, squeeze it well first. Damp and heat are wanted, not wet and heat. It is a good thing to have the sponge in the left hand nearly all the time, ready to take up any moisture or squeezed-out glue from the front of the hammer.—*Jour. of Applied Science.*

Clothes-Moths, and How to Get Rid of Them.

Prof. C. V. Riley gives the following very interesting account of the clothes-moth, and indicates the best methods of killing them:

"The name clothes-moths is applied to several distinct but similar species of minute moths belonging to the family *Tineidæ*, which, in their larval state, are very destructive to woollen goods, fur, skins, feathers and similar substances. Among them may be mentioned the clothes-moth (*Tinea vestianella*), the carpet moth (*T. tapetzella*), the fur moth (*T. pellionella*), and the hair moth (*T. crinella*). These Tineidæ have slender bodies, and lanceolate, deeply-fringed wings that expand 6-10ths or 8-10ths of an inch. The antennæ and palpi are short and thread-like, and there is a thick orange or brown tuft on the forehead. The colors range from buff to drab and dark gray. The eggs are laid in May and June (the moth dying immediately afterwards), and hatch out in fifteen days. The young worms at once pro-

ceed to work, gnawing the substances within their reach, and covering themselves with the fragments, which they shape into hollow rolls and line with silk. These rolls are by some carried on their backs as they move along, and by others fastened to the substance they are feeding upon, and they are enlarged from time to time by additions to the open extremities, and by portions let into the sides, which are split open for this purpose. In such ambush the worms carry on their work of destruction through the summer; rest, in seeming torpor, during the winter, and change to chrysalids early in the spring. They transform again in twenty days, and issue from their shelter as winged moths, to fly about in the evening till they have paired and are ready to lay eggs. Then follows an invasion of dark closets, chests, and drawers, edges of carpets, folds of curtains, and hanging garments, and the foundation of a new colony is swiftly laid. The early days of June should herald vigorous and exterminating warfare against these subtle pests. Closets, wardrobes, all receptacles for clothing, should be emptied and laid open, their contents thoroughly exposed to light and air, and well brushed and shaken before being replaced. In old houses much infested with moths, all cracks in floors, wainscots, shelves, or furniture, should be brushed over with spirits of turpentine. Camphor or tobacco should be placed among all garments, furs, plumes, etc., when laid aside for the summer. To secure cloth linings of carriages from the attacks of moths, sponge them on both sides with a solution of corrosive sublimate of mercury in alcohol, made just strong enough not to leave a white mark on a black feather. Moths may be killed by fumigating the article containing them with tobacco or sulphur, or by putting it, if practicable, into an oven heated to about 150° Fah."

Current Notes.

A Large Musical Box.—The Khedive has recently had made for him in Geneva what is said to be the largest musical box ever constructed. The case is of inlaid ebony. The instrument will play 132 tunes; it has eleven cylinders, and is furnished with flute, flute basso, drum, bells, and castanets. Each cylinder is 26 inches long. The box has cost £800.

Cementing Labels to Metal.—For attaching labels to tin and other bright metallic surfaces, first rub the surface with a mixture of muriatic acid and alcohol; then apply the label with a very thin coating of the paste, and it will adhere almost as well as on glass.

Stand for Cut Flowers.—A very pretty effect in the parlor or living room may be made by procuring a number of short vials something over an inch in diameter, or so large that they will stand firmly. In these place single roses, or other double blooms, wlth fern leaves or other pretty foliage below them. They will last thus a week, and be very beautiful.

Cure for Burns.—A solution of bicarbonate of sodium applied to burns, promptly and permanently relieves all pain. A laboratory assistant in Philadelphia having severely burned the inside of the last joint of his thumb, while bending glass tubing, applied the solution of bicarbonate of soda, and not only was the pain allayed, but the thumb could be at once freely used without inconvenience. Bicarbonate of soda is simply the best baking soda.

Another House Fired by a Milk Can.—Mr. Miles T. Frisbie, of Otisco Valley, N. Y., writes us that some years ago, on a hot day, he was somewhat astonished by seeing a smoke in his back kitchen, and tracing it to the wall, he found that the house had been set on fire by a pail with a concave bottom, which was set on a bench about 6 inches from the house. If the family had not been at home, the house would no doubt have been consumed.

Case Hardening.—Mr. F. H. Wenham, who is one of the most skilful scientific mechanics in England, contributes to the "English Mechanic" the following note on this subject: "In the directions generally given for this process, it is stated that the articles should be inclosed in a crucible or iron box filled with bone charcoal and carefully luted with loam. This is by no means necessary. The best practice in case hardening is to be seen in the lockwork and furniture of small arms. I have seen gunsmiths use a sheet-iron tray like a small frying-pan. A layer of fresh bone-dust is spread over the bottom of this, upon which the small finished and polished iron fittings are laid, avoiding actual contact with each other. Another layer of fresh bone-dust is spread over, so as to completely cover the articles. The tray is now filled to the top with burnt bone powder that has been used and exhausted by a previous operation. The tray is kept at a cherry-red heat over an open fire for about half an hour, and then the whole contents are instantly turned out into a vessel of cold water, and the articles will be as hard as possible, with the pretty mottled appearance characteristic of this kind of work. The bones are charred only sufficient to drive off the vapor, and just enable them to be coarsely powdered with a hammer. There is

no advantage in favor of hardness of surface by case-hardening at too high a temperature, as this impairs the quality of the bone by prematurely exhausting it, and driving off some of its combining elements, and great heat is also sure to warp the work. Gun-lock work, if properly done, comes out quite true for fitting in place."

An Instructive Experiment.—To prove that the inner dark portion of an illuminating flame contains combustible gases, the general practice with experimenters is to insert into that part of the flame a glass tube, so inclined that a portion of these gases shall rise into it, and thereupon igniting them at the further extremity of the tube, or leading the contents of the tube by an aspirator into a convenient vessel, when its combustibility can then be directly tested. Mr. Heuman has communicated to the German Chemical Society another method, and a simpler one, of accomplishing the result, which seems worthy of notice.

He recommends taking advantage of the well-known fact that a mixture of about four parts of chlorate of potassa and one part of strontium nitrate, heated to fusion, will burn with a very intense flame in hydrogen or illuminating gas, when once the ignition of the oxygen liberated from this mixture is effected by contact with a flame.

To perform this very pretty experiment, the author states that it is only necessary to fuse a small quantity of the mixture in question in a little spoon at the apex of a luminous gas flame, and then to lower it into the dark portion, when a brilliant combustion will immediately ensue; while, when removed to the luminous portion of the flame, or taken altogether out of it, it is at once extinguished.—*Journal of the Franklin Institute.*

BOOK NOTICES.

Manual of Telegraphy. Designed for beginners. By Prof. J. E. Smith. Thirteenth Edition. New York: L. G. Tillotson & Co., 8 Dey Street.

Telegraphy always has a peculiar charm for young people. Indeed we can think of nothing that will give more amusement than a short telegraph line connecting two families. The cost and labor of putting up such a line is very slight, and the manual named above gives such full and simple directions that any boy can follow them.

The Outlines of Natural Philosophy. For Young Children. By Edwin J. Houston, A. M. Philadelphia: Claxton, Remsen & Haffelfinger.

One of the most difficult tasks that one can undertake is to give such clear and simple explanations of the principles of Natural Philosophy as will be easily understood by children. Most of those who have attempted this task have failed from one of two causes: Either the explanations were erroneous, or they were beyond the comprehension of those to whom they were addressed. It seems to us, after a careful examination, that the author of the work before us has succeeded in avoiding both these errors, and he has consequently produced a book which must prove a great boon to parents who have intelligent children, eager for a knowledge of the material world around them. To such we would cordially recommend the little book on our desk. For the purpose intended it is certainly the best that we know of.

Off on a Comet! A Journey through Planetary Space. (A sequel to "To the Sun.") From the French of Jules Verne. By Edward Roth. With thirty-six full page illustrations. Philadelphia: Claxton, Remsen & Haffelfinger.

We hope none of our readers will treat this book as a certain staid old gentleman treated another of Jules Verne's works. After reading a few pages, he threw it down in disgust, and declared that he could not believe one word of it! However much the story may do violence to our sense of probability, or even of possibility, it is nevertheless undeniable that a great deal of the book is absolutely true. Like all works of art, it brings before us conditions of an unusual character, but of a higher grade than any that are likely to occur under ordinary circumstances. In the present instance we are brought face to face with the great laws of nature, operating under conditions such as no human experience ever realized. Our readers will find in this book not only an interesting story of strange adventures, but a great many new ideas in regard to the mechanism of the heavens. Through the whole there runs a vein of humor and anecdote which greatly relieves the dryness of the scientific discussions.

Inquiries and Answers.

Inquiries.

29. Can you give me a recipe for nickel or silver plating metals, with or without a battery? Will an electro-galvanic battery (shocking machine) serve the purpose of battery in plating wares? I manufactured one of your ten-cent batteries; it works like a charm, and I would like to know some experiments to try with it. J. N. H.

Answers.

30. In as concise a manner as possible, I shall attempt to answer an inquiry which appears in letter 27. The cheapest apparatus for charging a Leyden jar is the following: Place an ordinary iron tea tray on a perfectly dry tumbler; then warm a sheet of paper as hot as possible by passing it several times over a gas light, or by holding to a stove. Lay the paper on a board or other non-conducting surface, and rub it vigorously with a piece of india-rubber. Spread the paper on the waiter, to which the jar should now be applied. If the weather is

favorable for such ezperiments, the operation of warming and rubbing will only have to be repeated once or twice to charge the jar sufficiently. I hope that W. will find this method successful.

W. N. M.

31. In answer to J. F. M., to make skeleton leaves, I give him the following recipe, which he can try. The leaves are to be soaked in water for some time; the solid part will then gradually rot out, and leave only the fibres. These will be of a brown color, and must be bleached by means of a weak solution of chloride of lime (bleaching powder). The leaves must afterwards be carefully washed, so as to free them from the chloride of lime, otherwise they will speedily rot. They should then be dipped into a little gum water, and dried.

J. H.

EXCHANGES.

In this column yearly subscribers who may wish to *exchange* tools, apparatus, books, or the products of their skill, can state what they have to offer and what they want, *without charge*. Buying and selling must, of course, be carried on in the advertising columns.

Graham's Handbook, Synopsis, and 1st and 2d Readers Standard Phonography; tools or advanced scientific books preferred in exchange. E. H. Bidwell, Vineland, N. J.

Complete outfit for stamping key checks, worth $10, in exchange for practical receipt books, or bracket saw with lathe and drill attachment. John Whitty, Jr., Polloksville, N. C.

Woodward's Hospital Microscope wanted in exchange for chemical scales and weights; difference in cash. J. Siler, 1,212 Broadway, St. Louis, Mo.

For exchange, an entire printing outfit, cost $50; state what you have to exchange. F. R. Miller, 750 East Fourth street, South Boston, Mass.

Good $50 job printing press, in perfect order, for a scroll and circular saw, or scroll saw alone; saw must be in good order. Samuel J. Jones, Box 137, Oxford, N. C.

Wanted, foot power scroll saw, lathe, or both combined, or good microscope, for minerals, books on plant culture, Art Journal in parts, or cancelled postage and revenue stamps. D. S. Kimball, 48 Exchange Place, New York.

Wanted, small steam engine and boiler of from 1 to 2 horse-power; state what is wanted in exchange. Address Jno. McElvery, Flatbush, L. I.

Wanted, telegraphic and mathematical instruments; Pitman's Phonography in exchange; also thorough instruction in same by mail. F. S. P., King's River, Fresno County, Cal.

A set of chemicals and apparatus; also a set of wood engraver's tools, glass and instruction book, to exchange for a scroll saw and a microscope. The chemicals and tools cost nearly $40; will give a good trade. F. H. Jackson, Angelica, N. Y.

Wanted, a copy of Holtzapfel's "Mechanical Manipulation." State what is wanted in exchange. E. W., Box 4875, New York.

Wanted, a small turning lathe in exchange for a pair of telephones. J. C., care YOUNG SCIENTIST.

Scroll saw wanted in exchange for handsome portfolio of six water color sketches. Address F. S., care Box 4875, New York.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. H. A. Cutting, State Geologist, Lunenburgh, Essex County, Vt.

Wanted, complete Lester combination scroll saw in good condition; books in exchange. J. T. Jackson, Box 48, Metuchen, N. J.

Gold watch (cost $150) in exchange for a good microscope. E. W., Box 4875, New York.

Wanted, microscope, or scientific and mechanical books and apparatus, in exchange for printing press, cost $21, with or without type and material. J. P. Burbank, Salem, Mass.

Cigar machine to exchange for bracket saw or good microscope. Leonard Alexander, Linneus, Me.

Wanted, microscope; new Tillotson relay and part cash given in exchange. W. O. F., 83 Downing street, Brooklyn.

To exchange, a Kidder electric battery, for a private line telegraph instrument. Charles L. Feldkamp, 200 W. Randolph street, Chicago, Ills.

First-class scroll saw, double treadle, all improvements, worth $40, for second-hand Tolles' objective, not higher than 1-5. John D. White, Chicopee, Mass.

Camera for taking portraits wanted; state what is wanted in exchange. J. F. H., care of this journal.

Magic lantern, nine slides (two mechanical) in complete order, in exchange for good compound microscope. T. R. Barwood, Flatbush, L. I.

A work on painting and wood finishing, value $1.50, to exchange for scroll saw patterns. R. F. Hanscam, North Barnstead, N. H.

A good telegraph instrument, cost $7 50, for a couple of good books on chemistry, electricity, etc. H. B. Kinney, Hamlin, Brown County, Kansas.

Wanted in exchange for a second-hand scroll saw, treadle power and wooden frame, a good Excelsior microscope, or live box. Jos. G. Thorp, 54 West Seventeenth street, New York.

The Phonograph.—Our readers who reside in or near New York, can now have an opportunity not only of seeing and hearing this marvellous invention, but of listening to a very lucid explanatory lecture, which, by the aid of a series of striking and beautiful experiments, is rendered easy of comprehension, even by children. The exhibition is given every evening at Irving Hall, corner Irving Place and Fifteenth street, and in addition to the Phonograph, and Speaking and Singing Telephones, there are the attractions of exquisite music by Geo. Morgan, Madame Cole, Levy the cornet player, and others. The effect produced by the cornet playing of Levy, and the singing of Madame Cole and Mr. Rose, as reproduced by the phonograph, is marvellous. Amongst other feats, Levy played "God Save the Queen" into the phonograph in *four* octaves, and the instrument accurately reproduced his notes!

Those who wish to enjoy a very delightful entertainment, and to obtain a clear idea of the principles of the phonograph and telephone, cannot do better than visit Irving Hall.

The Young Scientist

SCIENCE IS KNOWLEDGE. KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL FOR AMATEURS.

VOL. I. NEW YORK, AUGUST, 1878. No. 8.

How to Make An Herbarium.

A Chapter for Young Collectors.

BY JOHN W. BUCK, B. SC.

As the summer advances doubtless many young lovers of nature will begin again gathering wild-flowers, and bringing them home in nosegays, as they have often done before, to be looked at for an hour or two and then, when withered, thrown away. Some may have tried ere this to dry them, and so to keep a record of their industry and their love for flowers, but may not have succeeded to their own satisfaction for want of a little help or instruction to begin with. It is for such that I intend this paper. To make a herbarium may sound a very imposing task, but such it need not be, for it can be done slowly and gradually—a plant at a time, if need be—and the flowers, when thoroughly dried and mounted, if taken care of, will keep an indefinite time and be a lasting source of enjoyment. Nothing is so conducive to a knowledge of our British wild-flowers as to make as complete a collection as possible of them; although those who take my advice and make the attempt will probably be surprised to find how few flowers they already know, and how many there are hidden away under the hedges or in the woods which they never saw before. An object such as this gives a new zest to our country walks, besides making us find out new ones; gives us pleasant associations with particular spots as being the places where we first found such and such a new flower, fern, or moss; and above all gives us new and brightened views of nature and of nature's God.

To collect flowers for an herbarium, all that is necessary is a tin box and a trowel, though some collectors prefer to carry a portfolio containing porous paper and to put the plant under pressure on the spot. This has the advantage of securing it, so that the flower shall lose none of its freshness while being carried home; but it is a cumbrous and troublesome plan, and it will probably

be found, in the case of most flowers, that if they are brought home in a biscuit-tin, and the roots perhaps placed in water to freshen them up if necessary before pressing, that they will appear as good as need be. It will nevertheless be found very convenient to carry a small pocket-book with some porous-paper leaves, in which to preserve at once some blossoms which will require it. For instance, it will be found impossible to bring home an entire dandelion or bindweed without the blossom closing up; and the corolla of the Germander Speedwell, the bright little blue flower often called bird's-eye or cat's-eye, that looks so pretty and lasts so long in the summer hedgerows, will almost certainly be knocked off before the plant can be pressed at home. In such cases these parts must be put under pressure separately from the rest of the plant, and at once. Indeed, such a sleepy plant as the tragopogon, or John-go-to-bed-at-noon, almost requires to be caught with guile. Go in the morning when it is open and press the blossom in the porous paper-book before detaching it from the stalk. Some entire plants, from their delicate and brittle nature, had better be pressed on the spot; as, for instance, the pale green moschatel, the stalks of which are almost sure to snap with the slightest rough usage. Of course, when the roots have to be cleared from much earth, especially if the earth is of a clayey nature, it is absolutely necessary to bring the plant home before doing anything with it. On the whole, the tin box will be found preferable to the portfolio, and the occasions on which the latter must be used will soon be learnt by experience. Better than either, because more convenient, is the regulation vasculum, of japanned tin.

For digging up the plants, since in most cases the roots must be preserved, a trowel is generally recommended. After a few of these have been broken by rough usage in stiff soils, or spoilt by friends who have borrowed them "just for once," they will probably be replaced by a small three pronged fork, about the same size as the trowel, but much more durable. Even this, however, has its disadvantage, which will be found out on trial. In selecting the specimens for preservation, a little discrimination should be exercised. It is best, perhaps, to take two plants of the same kind and dry both, and afterwards choose the best of the two for mounting. It is not advisable to take more, unless they are somewhat inaccessible, or unless, for other reasons, it should be difficult afterwards to obtain more if required, as a large number only fills up the box, takes up a great deal of room in the press, and gives much unnecessary trouble in many ways. Choose, therefore, two plants which are fairly developed, and which show if possible, specimens of all the kinds of leaves the plant may possess, which have some blossoms fully open and others in bud, and, in short, which are in all respects good specimens of their kind. In some cases the leaves are not up when the flower is open, as with the yellow coltsfoot, which flowers in the early spring, but whose leaves are not to be found until much later. It is a mistake to choose too large a plant, under the impression that it will look well; a medium should be aimed at in this matter, as in everything else. Perhaps it is not unnecessary to say that rare plants ought not to be exterminated. Persons who go about hunting for rarities, and who take all they can lay their hands on, are collectors *only*, not botanists. Many of our uncommon ferns are daily becoming rarer, and harder to be found by those who really want to study them, because they are so diligently sought after and dug up by collectors who only want them to sell. My advice is, if you find a rarity, take of it in moderation, and then, in the interests of science, keep your own counsel as to its whereabouts.

In removing a plant, care must be taken not to spoil the root, nor to injure the leaves that spring from near the ground. It is often of great importance that these latter should be kept intact, as they frequently differ from the leaves which grow higher up the stem, and are very useful in

assisting to determine the name of the species. With many plants, as is the case with the coltsfoot, the root will be almost sure to break off sooner or later. Again, a complete blue-bell, bulb and all entire, will be a very good certificate of perseverance for its possessor. The adhering earth should be shaken off as far as possible without doing injury to the roots, and the rest carefully pulled off at home, or removed by holding the root (only) under a stream of water.

The next thing ought to be to name the specimen; and if I could take for granted a little knowledge of botany on the part of my readers, it would not be very difficult to show in brief the easiest method of arriving at the correct botanical and popular names of most of our common wild flowers. For those, however, who know nothing of botany, the best way is to compare the flowers brought home with the illustrations in some such work as Ann Pratt's "Wild Flowers," or John's "Flowers of the Field," or Sowerby's "English Botany," or to obtain the help of some botanical friend. At all events, you need not despair of making good progress with your herbarium, even if you do not know the names of all the plants it contains, as these can generally be added afterwards.

In any case, proceed to dry your plants before they lose their freshness. This is accomplished by pressing them between porous paper. The best paper for the purpose is, or used to be, made by Messrs. Spicer, of New Bridge street, Blackfriars (who also supply white paper for mounting, in sheets about 17 in. by 11 in.), but in default of this, thick blotting paper is said to answer, though I have not tried it. The plants must not be damp when they are put in the press, and if the roots have been washed to clean them, they should be wiped as dry as possible. If for any reason the plants are at all damp, the papers should be changed very frequently at first, even twice a day, until the excess of moisture has been removed. I am frequently asked, "How is it you manage to keep the colors of your flowers so well?" Mainly by attention to this point—by not allowing the flowers to remain damp. Otherwise they are very apt to change their color; as, for example, the wood anemone, or windflower, which generally turns brown, but which may be kept white with proper care. Heath and firs are said to require a dip in boiling water before drying, in order to prevent the foliage from falling off. The same process prevents succulents, such as the curious flesh colored parasitic toothwort, from growing during or after pressure, by killing them at once. Here, also, the superfluous moisture should be removed by a handkerchief before pressing. Do not mix fresh specimens with dry ones, but separate them with several sheets of brown paper. Laying the plants out will often be found a troublesome process, and one which, in order to do it well, will in some cases require time and patience, but it is not of much use to give advice on this head, except to say that the various parts of the flower should be as well exhibited as possible. For instance, where the flower has a colored calyx and no corolla, as in marsh marigold, clematis, and wood anemone, one blossom should be folded up so as to show the absence of the customary row of green leaves below the colored ones. Or the same subject may be effected by completely reversing one blossom, so that its face is towards the paper. Where bracts, or small leaflets at the base of the flower stalks occur, as in orchids, they should be shown. The specimens should be distributed among the sheets of porous paper in such a way that the pressure may be somewhat equal in all places; but those plants, however, are likely to dry more quickly which are nearer the margin of the sheets. Thick stems had better be sliced in half longitudinally, as it prevents their taking up too much room, and also enables them to dry very much faster. The same course may be taken with thick roots or root stocks, as in primrose or coltsfoot; but in such cases care must be taken to leave enough root fibres adhering to the main

axis. Bulbs and corms, and the fleshy tuberous roots of orchids may also be sliced; some recommend scooping out the inside, but this is apt to make them break and spoil under pressure. Berries and stems that are not thick enough to slice may be repeatedly pricked on their under surface, or slashed with the point of a penknife, to let out the moisture. A very good plan with fleshy berries, and thick stems and roots, is to dry them, apart from the rest of the plant, by pressing them between several folds of porous paper, and baking the whole for three quarters of an hour in oven. But this does not always answer, and should not be tried with green leaves, as it is apt to turn them brown. In short, the more rapid the drying process the better; and hence the necessity of having recourse to these contrivances in order that the colors of the blossoms may not be injured through being kept damp by the slow drying of the thicker parts.—*Science Gossip.*

How to Study Entomology.

BY F. C. SMITH.

III.

Continued from page 90.

As far as possible the collector should secure duplicates of all larvæ, thus enabling him to preserve for study the insect in the different stages of its transformation. The caterpillars may be preserved in alcohol or glycerine, using the two or four drachm vials found at any drug store. For future reference, it is well to describe in the record the form, size, color, and peculiar markings of the larva. This will be of great value when ready to name the collection. Text books are published containing the names and descriptions of known species, but it is quite as well to wait until the collection is well started, before spending much time hunting for the names. While at work collecting, mounting, exchanging and putting up specimens, the collector will familiarize himself with the different species, and when ready to classify, name and arrange his cabinet, will consequently more readily recognize the descriptions given in his text-books.

Don't hesitate at all to inform your friends of your doings, and in a short time you will be surprised by receiving specimens from every source. By corresponding with friends at a distance, you can obtain many species common with them but rare with you.

One of the most accessible and pleasing transformations to the young student is that of the *Papilio asterias.* The larva of this butterfly is the common parsley or carrot worm. The color is green, with bands of black and yellow across the back. The feet have black tips. It does not spin a cocoon, but suspends itself by silken threads to the cover of the box in which it is confined, and the change from the larva to the chrysalis takes place very rapidly. In two days from the time it was feeding, it will undergo an entire change, both of form and color. The chrysalis will measure one inch in length, and the butterfly, when hatched, four inches across the wings. In the fall of the year a great number of pupæ may be collected, they being found in nearly every conceivable situation, from the tops of trees to six inches underground, and some even under water. These, if cared for, will reward the collector the next spring with a variety of butterflies and moths that are perfect. There will be no torn or disfigured wings, as oftentimes is the case when taken with a net.

Insects are divided into three parts—the head, the thorax, and the abdomen or stomach. The head is the first division of the body, and is provided with eyes, mouth, antennæ or feelers, and often with a long tongue or probocis. The thorax consists of three segments joined together, and each segment holds one pair of legs. The wings are attached to the posterior segments. The abdomen is always composed of nine segments, and contains the stomach and breathing apparatus.

All insects have six legs, never more or less. The caterpillar, if examined closely,

will be found to have but six true legs. The spider has eight legs, but it is not an insect. This may surprise some of our readers who are not familiar with entomology, but it tends to show that there is a great deal to be learned of the most familiar animals we meet every day.

Another curious fact about insects is that they do not breathe through the mouth, nor even through the head. The breathing holes are called spiracles, and are placed at the sides of the abdomen, usually nine on each side.

Insects that live under water come to the surface for fresh air, with the exception of a few that can live on the air contained in the water.

Some insects possess an incredible number of eyes. If we examine the eye of a fly under a microscope, we will perceive what looks to the naked eye to be but a single eye, to contain hundreds of eyes, of a hexagonal shape, arranged like the cells of honey comb. Each of these is a separate eye, and instead of moving its eye from side to side, as we do, the insect sees with the eyes that are nearest the object. Some of the beetles have 25,000 eyes, the dragon fly 12,000, the house fly 4,000, and the ant manages to see with 50.

The antennæ are two horn-like appendages joined to the head, one on each side, usually in front. Various forms are seen, some smooth and tapering to a point, and some in the form of a club, largest at the small end, while others are broad and branched like a feather.

The antennæ have puzzled entomologists more than any other organ of the insect. They are evidently used as feelers, and some have advanced the opinion that they are the organs of hearing as well. As yet no organs of hearing have been discovered.

To be continued.

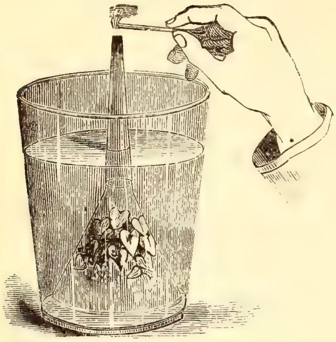
— Among the mechanical toys at the Paris Exposition, are dolls that swim, dive, and tread water, after the most approved human style.

An Interesting Experiment.

THE following experiment requires no special apparatus, and is not only very striking and beautiful, but very instructive. It has been clearly proved that plants breathe, and that by that breath they live. Every green leaf is a delicate lung, and acts the same part in the economy of nature that the lungs of animals do; separating from the air that element which the growth of the plant demands, and discarding or exhaling that which is of no service. And just as oxygen is required by the animal system, so for the support of all vegetable life, carbon is needed. When men breathe, they take into their lungs oxygen, which there combines with the carbon of the blood, forming a third compound gas, known as carbonic acid, which is breathed out, and in this state is of no value, but rather dangerous to animal life. Were there no way of restoring to the air the oxygen which is united to carbon in this gas, then would all animals sicken and die.

But, though the lungs of man and beast are not able to obtain the needed sustenance from the dangerous gas, it is not so with the leafy lungs of the plant. These organs are so formed that they take up freely the carbonic acid; and as, in this case, the food they want is carbon, they retain this, and breathe back or exhale oxygen, which is now free, and ready for man's use again. But how can you prove this fact, that plants breathe out oxygen? The answer is given in the illustration before us; and, as the apparatus used is extremely simple, an explanation of it will best convey our meaning. Having placed in a glass funnel a few fresh green leaves, invert it in a tumbler of fresh water, as here shown. Now close the opening above, and draw off some of the water in the glass. If this vessel be now placed in the sunlight, bubbles of gas will form on the leaves, and rise into the top of the closed funnel. When a sufficient quantity of the gas has so collected, pour in enough water to nearly fill the tumbler, remove the cork, and hold

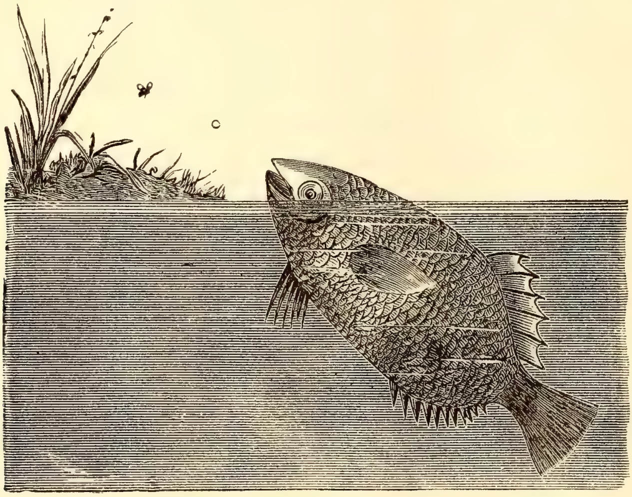
above the opening a glowing match or shaving—that is to say, a match which has a bright spark at the end, but no flame.



The result of this will be, that the gas which comes from the funnel will strike the glowing coal above, and cause it to burn so brightly that it will burst into flame—a result which is evidence, together with certain others, that the gas was oxygen. If carefully performed this experiment almost always succeeds. The best plants are those which grow in the water, either with the leaves submerged or otherwise. They must be exposed to bright sunlight, and two or three days may, in some cases, be necessary to obtain the needed amount of gas.

The Archer-Fish.

FOREMOST in the rank of animal-hunters and trappers, stands the archer-fish, the story of whose skill and cunning is so plainly told by the accompanying illustration. The brook-trout, owing to its slender form and marvellous muscular power, may leap its length above the water, and thus catch its food direct, and with no need of strategy. But with the archer-fish the case is very different. Nature has, it is true, given to it as hearty a love for insect food as is possessed by his more vigorous neighbor, the trout; but, alas, for the gratification of this taste, its body is heavy, and its fins and tail are none too powerful; and so, were there no other means for securing its food, this poor little fish might often go hungry to bed. But the same wise Power which gave to one of His creatures this appetite, provided also means whereby it might be gratified; and this is the way it is done: One of the myriad little bright winged insects, which swarm about the water-plants that fringe the edge of the crystal pool, having finished a sweet feast of honey, leaves behind him the blossoms of the water-thyme and lily, and sails boldly out over the surface of the pond.



THE ARCHER-FISH.

He is too high for the trout, and so there is surely no danger. Perhaps it is the music of his wings, or more likely the the shadow of his body on the water below, that attracts the attention of the little archer-fish, as he roves around among the weeds and pebbles of the pond.

Inspired by the prospect of a hearty meal, this water huntsman arms himself and is off. Slowly he approaches the surface, so directing his course that when his nose rises above the water, it shall be at that point nearest to the game he seeks. No sooner is the surface reached than away goes a little crystal bullet—a drop of water —and down comes the fly. So sure was his aim, and so powerful the force of the blow, that, though often three feet distant, and on the wing, the game is secured and borne down to the home among the pebbles.

The little fish which has so proved his skill as a marksman, is seldom over six inches in length, and is know to naturalists by the name *Texotes jaculator*. It is found in some of the fresh-water lakes of Japan. It is easily domesticated, and when secured in the aquarium, is active in the practice of its art, and seldom fails to capture or bring down the game at which it shoots its crystal bullets.

To Prevent "Day Dreaming."—Study mathematics; engage in solving problems; bring your mind down to matters of fact; read works on natural history, on the natural sciences; give up romance, novels, etc.; try your hand at mechanism; invent and use machinery; finish what you begin, and you will cultivate application and prevent the mind from wandering.

Microscopy.

Canada Balsam Microscopes.

THE article on penny microscopes in the first number of this journal was quite interesting to me, recalling to mind the balsam lenses I have made in times past. Of course these cheap lenses can not be used for scientific purposes, nor their performance be depended on for accurate work, nevertheless they may be made very instructive and entertaining, and with a good book, such as Rev. Wood's "Common Objects of the Microscope," or Lankester's "Half Hours with the Microscope," almost any person can learn enough to pay for the trouble of making the microscope and the money expended for the book.

About two years ago—it was before the summer of 1876—I made and experimented with some of these balsam lenses. I found it difficult to make a lower power than twenty diameters, with good definition, but the higher powers were much more easily made and gave far better results, but they had a very short working distance and were hard to use on that account. I used a pill box with a hole in both bottom and cover. Over the bottom (outside) was a thin piece of mica; on this mica, inside of the box, was a very small drop of balsam. For a diaphragm I used a piece of black tissue paper with a pin hole in it; this was gummed on the outside of the mica—the hole coming under the lens—and the edges turned down around the box, which was then covered with gilt paper. It then presented a very neat appearance.

The highest power I ever made, was three hundred diameters, and it had working distance enough to use No. 1 covers. I used to take considerable pleasure in "fighting" these balsam microscopes against cheap non-achromatic compound microscopes, such as Queen's and McAllister's "Household" etc. The balsam lenses would usually beat!

This morning I came across a box containing four of these balsam microscopes, among them was the one magnifying three hundred diameters. I took a slide of *Stauroneis Phœnicenteron* from my cabinet, and was surprised to see how plainly I could see them. I got a glimpse of the lines but they did not show very plainly until I moved my hand so that sunlight could strike them, when, to my surprise, I

saw them clearly and beautifully resolved. These lines number about 34,000 to an inch.

So much for balsam lenses. If any of the readers of this journal experiment in this direction, I should be pleased to hear what success they have.

ALLEN Y. MOORE.

Tulare, Cal., June 17, 1878.

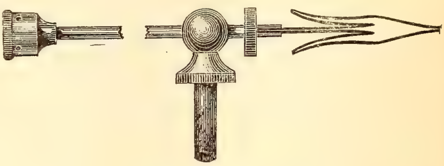
Paste Eels.

IN reply to a correspondent who asks how paste eels may be raised, one of our scientific cotemporaries says that paste, if left to turn sour, will soon swarm with these curious little creatures. The directions usually given are to boil flour and water, as in making ordinary paste, and set it aside until it becomes sour, stirring it occasionally so as to prevent the growth of mould. We have tried this plan over and over again, and have never succeeded once. We have kept the paste until it had passed through all stages of decay, but never, under ordinary circumstances, have eels made their appearance. And, indeed, it would evidently have been impossible to find them, unless they had either been developed by spontaneous generation, or the eggs or germs had been carried through the air. That they could be developed by spontaneous generation, few will believe, and that their eggs or germs are ever carried by the air, we have abundantly disproved by the following experiment: A jar of paste without eels was placed in the centre of six jars containing paste which seemed to be almost alive with them; these seven jars were allowed to stand for weeks, the only addition being a little well boiled (and cooled) water to keep the paste from drying up. Under these conditions the eels in the outer jars throve until the paste seemed to be literally a mass of eels and nothing else. But in the central jar no eels ever made their appearance.

The question arises then, How do the eels ever originate in paste, unless when placed there by design? The only solution that we have found to this question is that they come there from the water used to dilute the paste. It very frequently happens that river, pond or cistern water contains small eels very similar to the paste eel, and it is more than probable that these eels, developing rapidly in the new conditions in which they are placed, cause the paste to swarm with their progeny. Those, therefore, who desire to raise a stock of eels, must, after making the paste, add to it a little water from the bottom of a pond or cistern. In this way a start may often be obtained. But to merely expose a lot of boiled paste to the air until it becomes sour will in almost all cases end in failure. The easiest method, however, is to obtain from some friend a little paste containing eels, and add this to some paste that is three or four days old. The paste should be well mixed, and stirred daily to prevent the growth of mould.

A New Form of Stage Forceps.

THE stage forceps is such a useful and convenient accessory to the microscope that any improvement whereby it is made more perfect or less costly is of value. Mr. George Wale has invented a new form of this little implement, which is shown in the accompanying cut. It will be seen that the forceps proper are made of a single



WALE'S STAGE FORCEPS.

piece of sheet metal bent to a shape which, though easily understood, is peculiar and very difficult to describe. Under ordinary circumstances the forceps remain closed, and take a firm grip of any object placed between their prongs, but by pressing on the wing-like expansions of the metal strip forming the jaws, the latter open and the object falls out. These forceps can be made more cheaply than any others in market.

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As it is inconvenient to keep book accounts of these small transactions, those who remit the remainder of the yearly subscription are requested to state what numbers have been previously sent.

Articles in Preparation.

WE have in preparation a large number of very fine articles upon interesting and important subjects. Miss Samuels, of Quincy Point, Mass., has promised to furnish us with a series of articles on the art of Modeling Busts in clay and plaster. We have also a very excellent series on the Lathe, and the best methods of using it, by William B. Harrison, the well-known author of a work on small tools. The series on Botany, Entomology and Photography will also be continued, and we are promised some new and very interesting articles on boat building. An art which is also easily acquired by ladies, and which will enable them to produce very beautiful ornaments on glass by very simple means, will also be fully described and illustrated. Our readers will see, therefore, that we have made ample provisions for furnishing them with entertainment during the coming fall and winter.

Laboratory & Workshop

Crystallization.

Some very striking experiments are easily made with saturated solutions of certain salts. It is a well known fact that although under ordinary circumstances pure water will freeze when cooled to a certain point, it is possible to cool the water much below its freezing point without any formation of ice if we keep it perfectly quiet during the process. Any sudden jar, or the smallest particle of dirt dropped into the water, will start the crystals forming, and the entire vessel will be filled with them in an instant. In winter this is no uncommon occurrence, and it once happened that after a cold still night, the whole surface of a lake was suddenly transformed into a sheet of ice by a slight disturbance near the shore, and the crystals shot out from a point, and could be followed by the eye as they made their way to the other side—a phenomenon witnessed on such a scale by very few. A super-saturated solution is in a condition very much the same as the water cooled below its freezing point, a sudden movement in the latter case suffices to start the crystals forming.

If we take common Glauber's salts, sulphate of soda, which can be bought for a few cents per pound, and add it to boiling water, the water will take up a large quantity. The salt should be added until the water will take up no more while boiling. Remove the vessel from the fire, allow a moment for any suspended matters to deposit, and pour the clear solution, still hot, into a glass vessel, an ordi-

nary flask is as good as anything. Cover the mouth of the flask to keep out dust, and let it cool in a quiet place. When cold, the solution contains much more of the salt than cold water is capable of dissolving; hence it is super-saturated. If the glass is well cleaned on the inside the whole can now be carried about without change, but if we drop the smallest particle of a crystal of Glauber's salt into it, crystallization at once begins, and the contents of the flask become solid. This bit of crystal furnished a nucleus which determined the crystallization. The experiment can be repeated indefinitely by carefully heating the contents again until all the crystals dissolve.

We give another experiment on the authority of Peligot. The proportions are by weight. There are two solutions used—the first contains 150 parts of hyposulphite of soda dissolved in 15 parts of boiling water; the second 100 parts of acetate of soda dissolved in 15 parts of boiling water. Pour the first solution, still hot, into a tall glass, and then pour the second carefully on top, so that the fluids do not mix. Let the whole now cool, protected from dust. When we wish to see the crystals form, tie a small crystal of the hyposulphite on the end of a thread, and lower it into the vessel until it reaches the bottom solution. It will at once determine the crystallization of this. Drop now a crystal of the acetate into the upper solution, and this also will solidify, but the form of the crystals will be very distinct from the others. H.

How to Make an Æolian Harp.

One of our subscribers having requested us to describe a good method of making an Æolian harp, we give the following, which has been tested and found to work admirably: Of very thin cedar, pine or other soft wood, make a box five or six inches deep, seven or eight inches wide, and of a length just equal to the width of the window in which it is to be placed. Across the top, near each end, glue a strip of wood half an inch high and a quarter of an inch thick, for bridges. Into the ends of the box, insert wooden pins like those of a violin, to wind the strings around—two pins in each end. Make a round hole in the middle of the top, and string the box with small catgut or blue first fiddle strings. Fastening one end of each string to a metallic pin in one end of the box, and carrying it over the bridges, wind it round the turning pin in the opposite end of the box. The ends of the box should be increased in thickness where the wooden pins enter, by a piece of wood glued upon the inside. Tune the strings in unison, and place the box in the window. It is better to have four strings, as described; but a harp with a single string produces exceedingly sweet notes, which vary with the force of the wind.

Hints on Filing.

The following practical directions for using the file are extracted from "A Treatise on Files," recently published by the Nicholson File Company, and will be found of great value to amateurs:

Height of Work.—Various ideas very naturally exist amongst mechanics, as to the height at which the jaws of the vise should be set from the floor, for use in filing; arising largely, no doubt, from the varied nature of the work upon which the advocates of the different ideas have been accustomed to operate.

For filing general work, the top of the vise jaws should be placed so as to be level with the elbow of the workman, which will be found to range from 40 to 44 inches from the floor—therefore 42 inches may be considered as an average height, best suited for all heights of workmen, when the vise is to be permanently fixed.

If the work to be filed is small and delicate, requiring simply a movement of the arms, or right hand and arm alone, the vise should be higher, not only in order that the workman may more closely scrutinize the work, but that he may be able to stand more erect.

If the work to be filed is heavy and massive, requiring great muscular effort, its surface should be below the elbow joint; as the operator stands further from his work, with his feet separated from 10 to 30 inches, and his knees somewhat bent, thus lowering his stature; besides, in this class of work, it is desirable to throw the weight of the body upon the file, to make it penetrate, and thus, with a comparative fixedness of the arms, depend largely upon the momentum of the body, to shove the file.

It will therefore be seen that in fixing the height of the vise, the nature of the work and the stature of the operator should be considered, if it is deemed necessary to apply the principle correctly.

Grasping the File.—In using the larger files, intended to be operated by both hands, the handle should be grasped in such a manner that its end will fit into, and bring up against, the fleshy part of the palm, below the joint of the little finger, with the thumb lying along the *top* of the handle, in the direction of its length; the ends of the fingers pointing upwards, or nearly in the direction of the operator's face.

The point of the file should be grasped by the thumb and first two fingers, the hand being so held as will bring the thumb, as its ball presses upon the top of the file, in a line with the handle, when heavy strokes are required. When a light stroke is wanted, and the pressure demanded becomes less, the thumb and fingers may change their direction, until the thumb lies at a right angle, or nearly so, with the length of the file; the positions changing more or less, as may be needed to increase the downward pressure.

In holding the file with one hand, as is often necessary in filing light work, pins, etc., the handle should be grasped as already described, with the exception that the hand should be turned a quarter turn, bringing the forefinger on top, and lying along the handle nearly in the direction of its length. In this position, the freest action of the hand and wrist may be had upon light work.

Amateurs will find that by following these directions, the movements of the file will be simplified, and made somewhat easier than if grasped at random and without consideration.

Correspondence.

Drawing Boards.

Ed. Young Scientist—I have used drawing boards for many years; I used to think they must have cleats on the ends or back. When strong cleats are put on, as you direct, there is little or no advantage in gluing up the board from narrow strips; but where the board is so glued up, there is no occasion for any cleats; indeed it is better without them. The cleats confine the parts to which they are attached to one unvarying width, while the parts between the cleats are, in a measure, free to expand and contract with alterations of the hygrometric conditions to which they are exposed. Consequently the edges of the board cannot remain straight.

A double elephant board made of 4-inch strips, and 1¼ inches thick, will be abundantly strong without cleats; it will not warp enough to be troublesome, and the edges will stand much better than if made as you direct. It has the additional advantages of being cheaper, lighter, less bulky, and of having either side available. J. B. S.

BOOK NOTICES.

A Treatise on Files and Rasps: Descriptive and Illustrated. For the use of Master Mechanics, Dealers, etc.; in which the kinds of Files in most common use, and the newest and most approved special tools connected therewith are described, giving some account of their principal uses. With a description of the process of manufacture and a few hints on the use and care of the file. Published by the Nicholson File Co., Providence, R. I.

Although intended chiefly as a means for advertising the files of the Nicholson File Company, this handsome quarto volume contains a great deal of valuable practical information upon the subject of files in general and their use. It is well illustrated, and must prove a valuable addition to the library of any mechanic.

Current Notes.

Iridescent Glass.—Some specimens of ancient glass are remarkable for the exquisite iridescence which they display, some of them surpassing in beauty the colors on the neck of the dove. A recent number of "Le Propagateur," in commenting on this new iridescent glass, makes the following remarks in regard to its manufacture: "In Germany the glass to be iridized is heated, and a metallic oxide deposited on its surface by reduction. The oxide forms striæ on the surface, and these determine the phenomenon of iridescence. Bismuth seems to be much used in the principal glass works as the iridizing metal. In fact, M. Peligot, the eminent chemist, who has analyzed these iridescent glasses, found appreciable quantities of bismuth in them. Any metal whatever might, perhaps, produce the same result."

Indelible Indian Ink.—Draughtsmen are well aware of the fact that lines drawn on paper with good India ink which has been well prepared, can not be washed out by mere sponging or washing with a brush. Now, however, it is proposed to take advantage of the fact that glue or gelatine, when mixed with bichromate of potassa, and exposed to the light, becomes insoluble, and thus

renders India ink, which always contains a little gelatine, indelible. Reisenbichler, the discoverer, calls this kind of ink "Harttusch," or "hard India ink;" it is made by adding to the common article, when making, about one per cent, in a very fine powder, of bichromate of potash. This must be mixed with the ink in a dry state; otherwise, it is said, the ink could not be ground up easily in water. Those who cannot provide themselves with ink prepared as above in the cake, can use a dilute solution of bichromate of potash in rubbing up the ink; it answers the same purpose, though the ink should be used thick, so that the yellow salt will not spread.

Hatching Alligator Eggs.—The New York Aquarium has received from Florida a large number of alligators' eggs, and has made arrangements to hatch them artificially. This will prove an interesting and instructive experiment. It is expected that a young alligator will emerge from its shell every hour during the day, affording every visitor a chance to see the curious sight. This experiment will be the first of the kind ever tried, and should it prove successful, will be of considerable scientific importance. The attempt to keep California salmon alive during the hot weather has been successful. Heretofore these invaluable fish have invariably died during the summer months. At the Aquarium one of the tanks has been turned into a refrigerator, and these fish are now perfectly healthy.

EXCHANGES.

In this column yearly subscribers who may wish to *exchange* tools, apparatus, books, or the products of their skill, can state what they have to offer and what they want, *without charge*. Buying and selling must, of course, be carried on in the advertising columns.

Wanted, a 5 by 8 stereoscopic camera box; Fleetwood scroll saw, nearly new in exchange. L. L. Roberts, 1,203 Arch street, Philadelphia, Pa.

Wanted, good microscope and Vols. I and II of "American Journal of Microscopy, or thorough works on botany; thorough instruction in shorthand, by mail, in exchange. T. S. Price, King's River, Cal.

Wanted, in exchange for books, a second-hand aquarium. Address P. O. Box 124, Bridgeton, N. J.

A collection of postage stamps for small cannon or small printing press; will pay difference. C. L. Hackett, lock box 2,210, Roanoke, Ind.

To exchange a good magic lantern, painted slides, cost $8, for a music box of same price, in good order. L. D. Snook, Barrington, Yates Co., N. Y.

McAllister's Household microscope and American Agriculturist microscope, for small 5 or 6 inch turning lathe, or offers. J. Frank Weaver, Brooklyn, Conn.

Graham's Handbook, Synopsis, and 1st and 2d Readers Standard Phonography; tools or advanced scientific books preferred in exchange. E. H. Bidwell, Vineland, N. J.

Magic lantern, nine slides (two mechanical) in complete order, in exchange for good compound microscope. T. R. Barwood, Flatbush, L. I.

Complete outfit for stamping key checks, worth $10, in exchange for practical receipt books, or bracket saw with lathe and drill attachment. John Whitty, Jr., Polloksville, N. C.

Woodward's Hospital Microscope wanted in exchange for chemical scales and weights; difference in cash. J. Siler, 1,212 Broadway, St. Louis, Mo.

For exchange, an entire printing outfit, cost $50; state what you have to exchange. F. R. Miller, 750 East Fourth street, South Boston, Mass.

Good $50 job printing press, in perfect order, for a scroll and circular saw, or scroll saw alone; saw must be in good order. Samuel J. Jones, Box 137, Oxford, N. C.

Wanted, foot power scroll saw, lathe, or both combined, or good microscope, for minerals, books on plant culture, Art Journal in parts, or cancelled postage and revenue stamps. D. S. Kimball, 48 Exchange Place, New York.

Wanted, small steam engine and boiler of from 1 to 2 horse-power; state what is wanted in exchange. Address Jno. McElvery, Flatbush, L. I.

Wanted, telegraphic and mathematical instruments; Pitman's Phonography in exchange; also thorough instruction in same by mail. F. S. P., King's River, Fresno County, Cal.

A set of chemicals and apparatus; also a set of wood engraver's tools, glass and instruction book, to exchange for a scroll saw and a microscope. The chemicals and tools cost nearly $40; will give a good trade. F. H. Jackson, Angelica, N. Y.

Wanted, a copy of Holtzapfel's "Mechanical Manipulation." State what is wanted in exchange. E. W., Box 4875, New York.

Wanted, a small turning lathe in exchange for a pair of telephones. J. C., care YOUNG SCIENTIST.

Scroll saw wanted in exchange for handsome portfolio of six water color sketches. Address F. S., care Box 4875, New York.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. H. A. Cutting, State Geologist, Lunenburgh, Essex County, Vt.

Wanted, complete Lester combination scroll saw in good condition; books in exchange. J. T. Jackson, Box 48, Metuchen, N. J.

Gold watch (cost $150) in exchange for a good microscope. E. W., Box 4875, New York.

Wanted, microscope, or scientific and mechanical books and apparatus, in exchange for printing press, cost $21, with or without type and material. J. P. Burbank, Salem, Mass.

Cigar machine to exchange for bracket saw or good microscope. Leonard Alexander, Linneus, Me.

Wanted, microscope; new Tillotson relay and part cash given in exchange. W. O. F., 83 Downing street, Brooklyn.

To exchange, a Kidder electric battery, for a private line telegraph instrument. Charles L. Feldkamp, 200 W. Randolph street, Chicago, Ills.

Camera for taking portraits wanted; state what is wanted in exchange. J. F. H., care of this journal.

The Young Scientist

SCIENCE IS KNOWLEDGE

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL FOR AMATEURS.

VOL. I. NEW YORK, SEPTEMBER, 1878. No. 9.

How to Make Indian Canoes.

BY WM. B. HARRISON.

THE term "canoe" is of Indian origin, and is applied to boats made of bark, or the body of a tree hollowed and made into suitable shape for sailing purposes. The civilized so-called "canoe" is but a cheap, portable yacht, often clinker built, and bearing little resemblance to the canoe of savage manufacture.

In places where the white birch, or "canoe" birch grows to perfection, there the bark canoe is the favorite. Its chief merits are ease of construction and lightness; the latter an essential quality where portage is necessary, a bark canoe twelve or fourteen feet long being easily carried on the shoulders of one man, while one of twice that length is easily carried by two men.

The cheapest form of canoe is made of spruce, elm, hickory or bass wood bark. It is constructed by peeling the bark from a section of the tree, say twelve or fourteen feet long, and about eighteen or twenty inches in diameter. It is not necessary to fell the tree to obtain the bark. It is first girdled at the top and bottom for the length desired. The outside bark may be shaved off or not, as may be convenient. Then cut perpendicularly from girdle to girdle, and start the bark at the girdles with wooden wedges. Be careful and not split the bark. When peeled, let it down carefully from the tree, and spread flat on a level place, with the rough side uppermost. The inside of the bark is made the outside of the canoe. As the ends are to be closed together, shave thin at these ends, and, folding the bark, bring them together in the manner shown in Fig. 1, and tie a half round stick on each side to hold them thus, binding firmly both at top and bottom. By means of an awl, or bodkin, to make the holes, sew together the ends that project beyond the half-round sticks. Make the stitches crossing each other. When firmly sewed, cut off the sticks near the bark leaving enough to hold

the fastenings that bind them together. The next thing is to make two laps on each side, inclining toward the stern, as shown at *a*, *a*. This gives shape to the body of the canoe. As shown in Fig. 2, fit two thin strips, *c*, *c*, on each side of the gunwale, and fasten at bow and stern. Keep these apart by means of cross sticks, as at *b*, *b*. Shape the canoe, as near as possible, with stakes, sods or stones. Beginning in the middle, place ribs under the inside gunwale strips, fasten them, and continue bending until the bottom is reached, then bend up on the other side to the gunwale, cut off square and fasten firmly. Strings made of hickory, elm or bass wood bark, are used for binding. The paddle is shown in Fig. 3. The seat for the paddler or passengers must be in the bottom of the canoe. To sit otherwise would be at the risk of overturning.

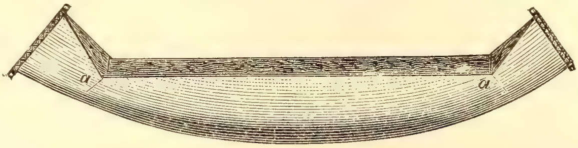


Fig. 1.

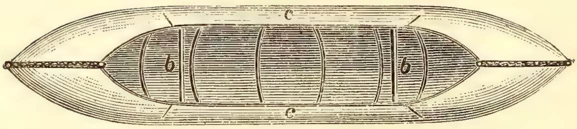


Fig. 2.

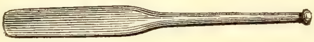


Fig. 3.

In building a canoe of birch bark (Fig. 4), the gunwales are first made of thin strips, preferably of cedar, about one-quarter inch thick and about one inch wide. One is to go on each inside, and one on each outside edge. The covering is prepared by sewing pieces of the bark together, which can be readily done before it gets dry and hard. The length of the canoe is then measured off on the ground, and stakes driven there, two at each end. The bark covering is then folded lengthwise, the inside of the bark outward, and the ends inserted and held between the stakes. The ends must project enough to allow a strip of bark to be folded over the ends and then firmly sewed from top to bottom. The gunwale strips are then placed in position, the bark placed between the pieces and there sewed. Cross pieces are placed between the gunwales to keep the sides in shape, as at *d*, *d*. The inside is then shaped, and lined lengthwise with thin strips of cedar, and strengthened with ribs which are placed crosswise, then bent down to the bottom, and so tied and fastened. The seams of the bark are smeared with pine gum or pitch.

The Ojibways had another method of making canoes. They dug a hole in the ground, the exact shape of the canoe to be built. Strips of thin wood about three inches wide, like barrel hoops, were laid crosswise of the excavation, and pieces of like shape were placed lengthwise. These pieces were then pressed into the hole and tied together, the hole being a sort of mould in which to press the strips, and so retain them until fastened, when they would keep this shape. The framework was then lifted from the hole, turned bottom side up, the covering of white birch bark laid over

it, folded in place and tied there. The caulking of the seams was done by a squaw holding the pitch in her mouth until softened, drawing it out into strings, placing it on the seams, and smoothing it down with a fire-brand. The Ojibways made twine from basswood bark by soaking the bark in water until nothing was left but the flaxy fibre. This was then twisted into cords and strings, to be used for canoe making and other purposes.

The log canoe (Fig. 5) is made from pine, whitewood, black ash, basswood and cottonwood. Pine is the best. After the tree is felled, the top and bottom of the intended canoe is shaped. The outline or gunwale lines of the sides are then marked out and shaped, the rule being to make the length into three sections, one being the bow, one the middle or body, and one the stern. A greater width in the middle gives ease of motion when sailing. After the exterior form of the canoe is made and finished, the inside is hewn or burned out. It can be made quite light by making the sides and bottom thin.

The bark canoe of the form given in Fig. 4 is considered the best. An improvement in the bark covering may be made by substituting sheet zinc. It is lighter, more lasting, less liable to become leaky, capable of greater speed, and may be made more symmetrical. A canoe of this kind about eighteen feet long, eighteen inches deep, and about three feet wide, may be made so as to weigh about fifty pounds, and will be capable of carrying seven or eight persons. Three sheets of fourteen-pound zinc will make the covering. Cut the zinc so that there will be four pieces, three feet eight inches long and three feet wide. Curve or round off the longest sides about three-fourths of an inch at the ends, to nothing in the middle. Bend the pieces up to nearly as possible the shape of the inside of the canoe. Stay them so with a strip or two, and solder them with tinner's solder, using muriate of zinc as a flux. If the two middle sheets be made proportionately wider than the others, when bent up, lapped about one-fourth of an inch and soldered, and the edges properly rounded, the bottom will be of the proper curve. Place the other pieces, one on each end of these two pieces, and solder in like manner. Take two other pieces of zinc, fold them together like the ends of the bark canoe, solder one end of each, and fit the open end to the pieces already soldered; mark how they should fit, cut properly, lap and solder. There will be four spaces left at the corners of the curve, which will have to be covered with pieces cut to fit and then soldered. Remember to solder well, both inside and outside. Place two thin strips of wood, one on each side of the zinc, at the upper edge for gunwales; form a curve outwards and upwards, and nail through both strips

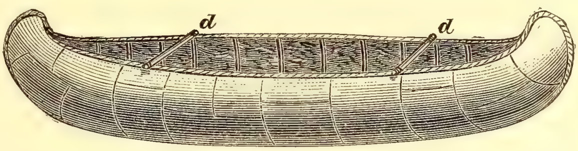


Fig. 4.

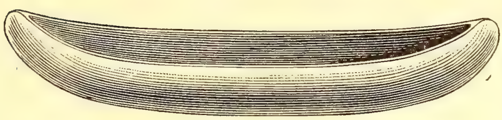


Fig. 5.

and zinc. Put in thin ribs, the same as in the bark canoe, and stay them with rivets. Paint any color to suit the fancy. The paddle used is the same as for the bark canoe.

To make the paddle (Fig. 3), take a strip of light wood, about three feet eight inches long, make the blade one-half the length of the paddle, and four or five inches wide. Make it thin, so as to spring. The paddle is used on one side of the canoe, and is never crossed only to change hands for a rest.

How to Make an Herbarium.

BY JOHN W. BUCK, B. SC.

Continued from page 104.

IN speaking of laying out the specimens, I omitted to give one hint which may be of service; I refer to the judicious use of the scissors. It will sometimes be found advantageous to cut away leaves and blossoms from what we may call the back of the plant, when there are too many of them, and when they would conceal one another's shape by their number. It has the effect also in many cases of making the specimen look more natural, since, when growing, the branches of a bushy plant do not incommode one another, but spread out equally on all sides. A bunch of berries—those of the spurge laurel, for example—must generally be partly cut away. Sometimes it is well to postpone the operation until the specimen is dry and ready for mounting. But be very cautious that in cutting you do not disfigure the plant, or deprive it of some important feature. Every plant has its characteristic kind of inflorescence, or flower arrangement, and also of leaf-arrangement, and if you snip away recklessly you will produce effects that will sadly puzzle any botanist who may afterwards look over your collection.

The pressure necessary for the thorough preservation of the plants may be caused by large books laid over the papers, with a few bricks on top, or by strapping the papers together between two strong boards. The latter plan I prefer, and almost always make use of, because the whole affair can be carried about from place to place if required, or set before a fire to dry quicker, which is often a great convenience. I need hardly say that, however the plants are pressed, they should always be in as dry a place as possible. As regards the amount of pressure to be applied, it should be borne in mind that the object is not to squash the plants, but to keep them flat and dry them; and hence, especially with succulents, a too excessive pressure should be avoided. If, however, enough paper be interposed, and the specimens well distributed among the sheets, ordinary plants will take no harm under any reasonable pressure.

In transferring the plants, when changing the sheets of porous paper, it will be found advantageous not to lift up each plant by itself and place it on another sheet, but to adopt the following plan. After having lifted away the damp sheets above the plant—which must be done with great care, by turning them slowly back with the right hand, while guiding and moderating the operation with the left, which should be held down on the upper surface of the paper you are removing,—place a dry sheet over the plant. Then take up the two uppermost sheets, with the plant between them, carefully invert them, lay them on the pile of dry sheets, and lastly skin off the damp sheet in the same way as before. Even by this method it will not be found easy to keep the blossoms and leaves of some plants smooth, as they are so apt to stick to the papers. All blossoms that are at all troublesome had better be dried separately; and in the case of such as poppies, they should be protected by a couple of pieces of tissue paper, which should not be removed until the drying process is quite over. The chief difficulty in transference will be found only while the plants are damp, and will disappear entirely as they get drier. The damp sheets should be completely dried before using them again, by exposing them to warm, dry air.

There are several ways of judging when

the plants are dry. In the first place, a thoroughly dry plant is generally rigid, unless it be very long and weak. Feeling of the plant by the lips, or placing the hand on the sheet of paper from which it has just been taken, are other tests, but in these cases you must distinguish between coldness and dampness. Generally speaking, you may rest satisfied that if the specimen has been under pressure, with dry and frequently changed papers, for eighteen or twenty days, it is likely to be quite dry, unless its nature is such as to make the matter doubtful.

Now comes the mounting, which should not be deferred, as postponing it probably means spoiling the specimens and losing the labels, and certainly means an accumulation of work at some future time. For fixing the plants, some recommend the application of hot glue; but this is very troublesome to manage, and as the operation of carefully gluing a large specimen is rather a long one, the glue is not likely to be very hot when the time comes for fastening it down. Strong gum answers quite as well and is more convenient. To make the gum, take one ounce of picked gum arabic, as colorless as possible, powder it, and stir it with a clean stick or a glass rod in an ounce and a half of cold water until it is dissolved; add a quarter of an ounce of powdered gum tragacanth ("gum dragon"); and lastly, add two grains of corrosive sublimate, previously dissolved, along with two grains of sal ammoniac, in one drachm of water. A metal stirring-rod should not be used, as it is apt to discolor the liquid. The latter, if carefully made, is quite colorless, and does not show much, if any be accidentally smeared. (N. B.—Corrosive sublimate is very poisonous, and the bottle of gum containing it should be labeled "Poison.")

To be continued.

—Prince Leopold, the youngest son of Queen Victoria, has written a book upon the Polarization of Light, which is to be published during the present year.

Simple Lessons in the Art of Photography.

THE SILVER BATH.

Continued from page 92.

THE cause that so many amateurs fail completely in photographing may, in nine cases out of ten, be traced to the silver bath. Any one not practically acquainted with photography will undoubtedly be greatly surprised on being informed that more mistakes will occur in making the silver bath than in compounding any other liquid used in photography. The whole secret of making a good silver bath that will produce clear negatives and keep its good properties for a reasonable time, lies in the application of heat, in one form or other, in order to effect a chemical mixture of the nitrate of silver in water.

It is true that nitrate of silver is readily dissolved in water in greatly varying proportions, but without the action of light or heat the mixture will rather be mechanical than chemical, and the results obtained with such a bath will be entirely unsatisfactory. Nitrate of silver of chemical purity can be bought either from druggists or dealers in photographic materials at such a comparatively low price that it will not pay to incur the trouble of making it. Distilled water is not absolutely necessary, but under no circumstances should spring water be used. Ice water or rain water do very well.

The best way to proceed in making a silver bath is as follows: First clean from all impurities, by means of sulphuric or nitric acids, the bottle which is going to serve as a temporary receptacle for the silver solution. Select a bottle of white glass. Fill the bottle with 12 ounces of water, and dissolve in it 1 ounce nitrate of silver. The bottle should now be placed for ten or twenty hours in the full sun, where the liquid will gradually change into red brown, or even black, and finally, after the settlement of some dark-colored sediment on the bottom of the bottle, the fluid will exhibit the purest crystalline transparency. The settlement of the sediment is the sign that

the process of purification is complete, and that the nitrate of silver is dissolved. While this is going on, it is advisable to stir the mixture occasionally.

By the direct application of heat, the same object can be accomplished. The liquid is poured into a porcelain or glass vessel, gradually heated, and kept boiling for from 10 to 20 minutes. In order to avoid a reduction of the given quantity of the silver solution by evaporation, the nitrate of silver should be dissolved in 14 ounces of water. In the latter operation the impurities will float on the water. As soon as the liquid, if it has been boiled, is cool, or if treated by the first method, is transparent like crystal, two grains of iodide of potassium, dissolved in a drachm of water, are added, and by frequent stirring thoroughly incorporated into the silver solution, which is then left undisturbed for half an hour. At the expiration of this time the solution is filtered through double filtering paper into another clean bottle, where even the most careful inspection should be unable to discover the slightest impurities. The addition of one drop of nitric acid will insure clear negatives and prevent fogginess. Repeated stirring, and a rest of half an hour, will be found also indispensable to effect a thorough union of the acid with the silver solution.

The silver bath is now ready for use, and will keep in good order for a longer or shorter time, according to the degree of cleanliness and care with which it has been treated.

Sometimes the addition of another drop of nitric acid will be found necessary to prevent fogginess, but generally only in cases where the water used for the nitrate solution is strongly alkaline.

The silver solution should be slightly acid. Litmus paper, which can be had in every drug store, should, in contact with the bath, turn only slightly red.

The silver solution should be completely saturated with iodide. This second point can be tested by the addition of some weak solution of iodide of potassium in water, which, in case of previous saturation, will render the liquid turbid. The silver solution should be free from every odor or smell.

With proper care 12 ounces of bath will sensitize 50 to 80 quarter plates. Small baths generally require a second or third addition of iodide after a number of plates have been dipped, an inconvenience to which larger baths are not liable.

THE DEVELOPER.

In the wet collodion process, there are two developing solutions, the protosulphate of iron developer, and pyrogallic acid developer.

Formulæ for iron developer: 1. Water, 16 ounces; protosulphate of iron, 1 ounce; acetic acid, ½ to 1 ounce.

2. Water, 16 ounces; protosulphate of iron, 1 ounce; pure sulphuric acid, 1 to 2 drops.

The iron salt is pulverized and intimately mixed with the given quantity of rain water. Add now the acid, when, after filtering, the solution is complete. If the developer does not flow well, half an ounce of alcohol should be added.

The quantity of acid that must be used depends upon several circumstances. In summer, when the temperature is high, it has to be increased, while in cold weather it may be diminished. The action of the iron salt without acid is too energetic and unmanageable. As a general rule, long exposure requires a weak developer, while short exposure, especially instantaneous pictures, demand a very small quantity of acid. Too large a quantity of acid will produce fogginess. The presence of acid exercises also a certain influence upon the character of the whole deposit: the more acid the finer the deposit, and conversely the less acid the grosser the granulation. Diminishing the iron salt in the same quantity of water also weakens the reducing properties of the developer, though a certain quantity of acid is always necessary to prevent fogginess.

Formula for pyrogallic acid developer: 6 grains pyrogallic acid; 6 grains citric

acid; 3 ounces water. The pyrogallic acid and the citric acid are dissolved in water when the solution is ready for use. This solution does not keep very well, and should always be prepared fresh. This developer requires a longer exposure than the iron developer, and is more appropriate for negatives than for positives. The quantity of citric acid can be modified to the same circumstances which regulate the treatment with acetic acid in the iron developer.

In making either positives on glass, or ferrotypes, it is desirable to have a white, metallic-looking film. The addition of one drop of nitric acid, 10 grains nitrate of potassa, and a few drops of silver solution to the first formula, will accomplish the desired end.

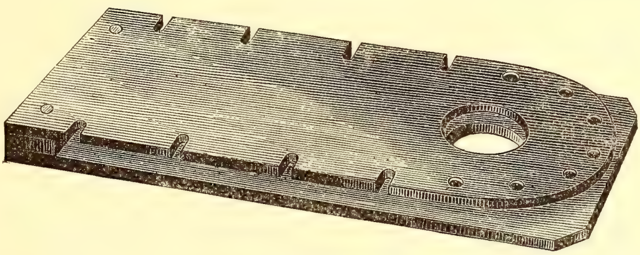
The developer renders the latent picture upon the collodion film visible. It produces a decomposition of the silver solution in such a manner as to leave the metal in a reguline condition only on those places which have been acted upon by light.

Microscopy.

A New Form of Frog-Plate.

THE circulation of the blood in the foot of the frog has always been a favorite subject for exhibition. The subject is so easily prepared, and it may be seen by such ordinary instruments, that few persons who own a microscope need be deterred from attempting to see it themselves, or to show it to others. Of the many forms of apparatus specially designed for holding the frog and displaying its foot, the common brass frog-plate has been most generally used, but it has this disadvantage, that after the frog has been properly secured, it is almost impossible to move the plate under the clips, which, in the cheaper microsoopes, serve to retain the object in place on the stage. A very simple addition to the ordinary frog-plate serves to remedy this defect, and enables the observer to bring under view any part of the web of the foot.

This frog-plate consists of two plates firmly rivetted together at one end, with a strip between them which holds them a little more than an eighth of an inch apart.



A NEW FORM OF FROG-PLATE.

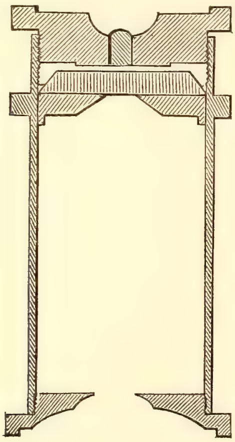
The under plate is plain, with a hole which corresponds with the hole over which the web of the foot is stretched. This lower plate passes under the clips of the stage, which retain it securely, but allow perfect freedom of motion. The frog, after being swathed in a strip of moistened muslin, is tied to the upper plate, the notches at the side of which hold the windings of the string from sliding. Around the large hole over which the web is spread, there are several holes, the object of which is as follows: After the frog has been tied to the plate, its position being so regulated that the web of the foot will come fairly over the hole, the operator takes three pieces of thread, each having a slip-knot at the end. These slip-knots are passed over the toes and drawn tight; the free ends are passed through such of the small holes as are best

adapted to spread the web, and by means of small wooden pins, are fixed there. It is well to place a piece of very thin plate glass or thick covering glass under the foot, which must be kept thoroughly saturated with water. After considerable use of this frog-plate, we find it the most convenient we have ever used. It may be made of any suitable material; our first was made of an old cigar box, and then we had some made of brass, but we find that hard rubber is superior to anything else.

A Collecting Microscope.

THINKING that anything new in the way of microscopes may interest the readers of this journal. I send you a sectional cut (full size) of an immersion collecting microscope, recently made for me by the Spencers, of Geneva, N. Y.

I have found it quite valuable when after desmids, diatoms, etc., as it is a compressorium and animalcule cage, as well as a



microscope of seventy-five diameters. The metal part is of well finished brass.

When the mounting of the lens is screwed down as far as it will go, the front surface of the lens comes in contact with the thick glass stage. This latter is beveled around the edge, similar to a first-class animalcule cage, and when the screw is slightly oiled, objects in fluid may be kept for a long time, as it is then air-tight, and evaporation prevented. The focus of the lens is at its plane surface.

The drawing makes any further description unnecessary. ALLEN Y. MOORE.

Tulare, Cal., July 9, 1878.

Pond Hunting.

THE writer has frequently, and probably in common with many other microscopists, thought with regret of the truth of Mr. Crouch's assertion before the Quekett Microscopical Club, to the effect that pond life is a subject with which American microscopists are generally but little acquainted, *Volvox globator* being an unfamiliar object to many. Granting that the *volvox* is not as common here as in England, as is undoubtedly the case, for the writer has, during the last three Summers, explored the ponds and ditches considerably without finding it, the substance of the charge is only too true. The reason may be urged that the Americans are too practical and busy a people to spend time exploring puddles and ditches where neither funds or fame are to be found, but even microscopists find time for amusement now and then. The national dislike to walking, and an equally characteristic aversion to open air pastimes generally, are no doubt among the principal reasons for the neglect of a flora and fauna full of interest and beauty. Our running streams and still lakes alike offer new species to the collector, and it certainly seems to the writer that no object can sooner bring its reward of absorbing interest to the individual, and no branch of microscopical study requires less previous preparation or accessory apparatus.

In the course of a walk along Forty-fourth street, near the lake shore, Chicago, a short time ago, a little pool, barely two yards wide, was observed, from which ran a rill of not more than a teacupful capacity. A dip of the vial brought up at least a dozen little green atoms, nothing else but *volvox*, while further queries with the dipping bottle resulted in a find of the greatest variety of animal and vegetable life. Mr. Atwood, one of the party, names the following

among the entomostraca and infusoria: Cyclops quadricornis, Canthocampus minutus, sundry of the cypris tribe, Actinophrys sol, Rotifer vulgaris and Anguilula fluviatalis, while among the algæ Mr. Colgrove reports: Oedogonium mirable, Chætophora elegans, fragments of nostoc, Closterium lunula, C. acerosum, Cosmarium teteropthalmum, C. Botrytis, Euastrum verrucosum, Staurastrum punctuatum, several species of diatoms, and the volvox.

Two, at least, of the party had never seen a live *Volvox globator* before, and if not unduly enthusiastic at the sight of the little living globe rolling gracefully across the field of the microscope, did not restrain their exclamations when one gave birth, in a Cæsarean style, to a family of eight, each of which, after a moment's rest, set their cilia in motion, slowly at first, afterwards more rapidly, and moved away on their voyage of life.

Now the moral of this little tale is two-fold—First, do not remain in ignorance of the beautiful forms that fill with life the ponds and streams around us, for instruction may be gleaned by the student, and entertainment by the dilettante from them; and, second, always take a collecting bottle when you go out walking.

Rules for Using Glue.

Glue, being an animal substance, it must be kept sweet; to do this it is necessary to keep it cool after it is once dissolved, and not in use. In all cases keep the glue-kettle clean and sweet, by cleansing it often.

Good glue requires more water than poor, consequently you cannot dissolve six pounds of good glue in the same quantity of water you can six pounds of poor. The best glue will require from one-half to more than double the water that is required with poor glue, which is clear and red, and the quality of which can be discovered by breaking a piece. If good, it will break hard and tough, and when broken will be irregular on the broken edge. If poor, it will break comparatively easy, leaving a smooth, straight edge.

In dissolving glue, it is best to weigh the glue, and weigh or measure the water. If not done there is a liability of getting more glue than the water can properly dissolve. It is a good plan, when once the quantity of water that any sample of glue will take up has been ascertained, to put the glue and water together at least six hours before heat is applied, and if it is not soft enough then, let it remain longer in soak, for there is no danger of good glue remaining in pure water, even for forty-eight hours.

The advantage of frozen glue is that it can be made up at once, on account of its being so porous. Frozen glue of same grade is as strong as if dried.

If glue is of first-rate quality, it can be used on most kinds of wood work very thin, and make the joint as strong as the original. White glue is only made white by bleaching. E. N.

A Story of Science.

BY ONE WHO KNOWS NOTHING ABOUT IT.

A philosopher sat in his easy chair,
  Looking as grave as Milton;
He wore a solemn and mystic air
  As he Canada balsam spilt on
A strip of glass, as a slide to prepare
  For a mite taken out of his Stilton.

He took his microscope out of his case,
  And settled the focus rightly:
The light thrown back from the mirror's face
  Came glimmering upward brightly.
He put the slide with the mite in place,
  And fixed on the cover tightly.

He turned the instrument up and down,
  Till getting a proper sight, he
Exclaimed—as he gazed with a puzzled frown—
  "Good gracious!" and "Highty-tighty!
The sight is enough to alarm the town—
  A mite is a monster mighty!"

From t'other end of the tube, the mite
  Regarded our scientific,—
To its naked eye, as you'll guess, the sight
  Of a man was most terrific,
But reversing the microscope, made him quite
  The opposite of magnific.

"One sees the truth through this tube so tall,"
  Said the mite as it squinted through it,
"Man is not so wondrously big after all,
  If the mite-world only knew it!"

MORAL.

MEM.—Whether a thing is large or small
  Depends on the way you view it!

Fun.

THE

YOUNG SCIENTIST.

PUBLISHED MONTHLY.

TERMS—Fifty Cents per year. ☞ Postage free to all parts of the United States and Canada, except New York City. Our absurd postal laws make the charge for delivering our journal to subscribers in New York city five times as great as that required for transporting it across the continent, and delivering it to subscribers in San Francisco or New Orleans. We are therefore compelled to charge our New York subscribers 12 cents extra.

ALL COMMUNICATIONS should be addressed to

THE YOUNG SCIENTIST,

P. O. Box 4875. 176 Broadway, New York.

☞ For Club Rates, etc., see PROSPECTUS.

Our Trial Trip.

IN offering four numbers as a trial trip for 15 cents, our object is to give to those who are interested an opportunity to examine the journal more fully than can be done by the inspection of a single number. Our rule is to send the four numbers at once, and the numbers that are sent vary from month to month, being always the last four that have been issued.

As it is inconvenient to keep book accounts of these small transactions, those who remit the remainder of the yearly subscription are requested to state what numbers have been previously sent.

A Liberal Offer.

EVERY one knows that the greatest obstacle in the way of extending the circulation of a new journal, provided it has any merit, is the difficulty of bringing it before those who are likely to subscribe. In proportion to the results obtained, miscellaneous advertising is too expensive, for those who are likely to take a journal like ours are in a comparative minority. Thus far, however, our success has been quite encouraging, and now, in order to increase this success still further, we have determined to enlist the efforts of every one of our present subscribers by the following liberal offer, which, be it remembered, applies only to those whose names are now on our books.

Any subscriber sending us two new names, with the money—$1.00—will receive his own copy for 1879 free. That is to say, we will, to our present subscribers, give three copies for one dollar.

In doing this we have two objects in view. In the first place we are anxious to extend our circulation as much as possible, and in the second we desire to acknowledge our sense of the good feeling which has prompted so many to support a new, and to them untried enterprise.

During the coming months we expect to make the YOUNG SCIENTIST more than ever worthy of the support of its readers. Our draughtsmen and engravers have their hands full of good things in store for the journal, and as we intend to enlarge the journal permanently next year, adding four more pages, we feel confident that during 1879 both our readers and ourselves will have "a good time."

Laboratory & Workshop

Hints on Filing.

Carrying the File.—The most natural movement of the hands and arms in filing, is to carry the file in circular lines, the several joints of the limbs being the centres of motion; this movement of a convex file would apparently give a concavity to the work. The real tendency, however, especially on narrow work, is the reverse, (owing to the work acting as a fulcrum, over which the file moves with more or less of a rocking motion,) giving an actual convexity to its surface, except when in the hands of a skilful operator. The real aim, therefore, should be to cause the file to depart

only so much from a true line as will be necessary to feel that each inch of its stroke is brought into exact contact with the desired portion of the work.

The movements here referred to, have reference to those in which both hands are used upon flat work, requiring nicety and trueness of finish, and the difficulties to be overcome in producing even a comparatively true flat surface with a file, require much practice on the part of the operator.

In filing ovals and irregular forms, the movements, while not considered so difficult or trying, nevertheless require considerable experience, and a good eye, to so blend the strokes of the file upon the round or curved surfaces, as to give the best effect; the varied nature of the work upon this class of surfaces, though much might be said, prevents any detailed definition as to the movements of the file, within the limit of this article.

In point of economy, the pressure on the file should be relieved during the back stroke; this will be apparent to any one who will examine the formation of the points of the teeth, when it will be seen that the file can only cut during the ordinary or advancing stroke, and that equal pressure during the back stroke must be very damaging to the points of the teeth.

Draw-filing.—Files are sometimes used by grasping at each end, and moving them sidewise across the work, after the manner of using the spoke-shave. This operation is known as draw-filing, and is usually performed in laying the strokes of turned work lengthwise, instead of circular, as left from the lathe finish, as well as when giving a final fit to the shaft that is to receive a coupling—cases, generally, in which no considerable amount of stock is to be removed. Thus, any defects in the principle of construction, or arrangement, of the teeth of the file, are not so readily apparent.

Files, as they are ordinarily made, are intended to cut when used with a forward stroke, and the same file cannot work smooth, or to the best advantage, when moved sidewise, unless care is taken that the face of the teeth present themselves, during the forward movement of the file, at a sufficient angle to cut, instead of scratch the work. To accomplish this, the angle at which the file is held, with respect to the line of its movement, must vary, with different files, depending upon the angle at which the last, or up cut is made. The pressure should also be relieved during the back stroke, as in ordinary filing.

When properly used, work may be finished somewhat finer, and the scratches more closely congregated, than in the ordinary use of the same file; as in draw-filing the teeth produce a shearing or shaving cut.

First Use of a File.—In economizing the wear of files intended for general purposes, consideration should be given to the kind of material which they may be subjected to in the different stages of their use.

In the ordinary use of the machine shop, the first wear of these files should be in finishing the larger surfaces of cast iron, bronze, or brass metals, all of which require a keen cutting tooth; they may then be made to do good execution upon the narrower surfaces of these metals, also upon wrought iron and soft steel; although to obtain the best results, the file suited for general purposes is not so well adapted to filing brass, or other similar soft metals, as those whose teeth are arranged for this purpose.

Mucilage.—A good mucilage to be used for pasting newspaper clippings into scrap books, and one that will not cause the paper to become transparent to the detriment of the reading, may be made by putting a few cent's worth of gum tragacanth into a wide-mouth vial or a small jar, and turning in water sufficient to a little more than cover the gum. Before putting in the water, add a little acid to it; a few drops of vinegar or sulphuric acid will do. This will prevent decomposition and a disagreeable smell. If desired a few drops of any essential oil may be added to impart an agreeable odor.

The American Institute.—The exhibitions of this association have for more than half a century constituted the "Permanent Exhibition" of New York, and whether considered as a means of education, through the display of valuable products and processes, or as a most effectual means of bringing to the notice of the public the novelties which are brought forward every year, the Institute Fairs have always stood foremost amongst the exhibitions of this country—always, of course, excepting the Centennial. The Exhibition opens this year on the 11th of September, and those who desire to avail themselves of its advantages should make haste to address the Secretary, whose office is in the Cooper Union building.

Inquiries and Answers.

Inquiries.

32. Can you give me a recipe for making fusible metal that will melt in water? Also, how is artificial coraling done on wood or metal? ***

33. Can any of your readers tell me the proportions of sulphate of ammonia and nickel for making an electroplating solution? A. W. P.

34. Please state through the columns of THE YOUNG SCIENTIST, a cheap outfit for mounting insects for the microscope. SUBSCRIBER.

35. Do you know of a dissolvent or a softener of printer's ink when dry? I want to take impressions on glass of scientific and other pictures for lantern slides, as many are very desirable and not in any catalogue of slides. C. I. S.

36. An acquaintance of mine has a knife with his name eaten into the blade by some kind of acid. Will some one tell me what kind of acid is used for this purpose, and how to apply it? B. G. P.

Answers.

37. In answer to J. N. H. (29), Watts gives the following solution for gold and silver plating without a battery: 1 oz. of nitrate of silver dissolved in 1 quart of rain or distilled water. When thoroughly dissolved, add a few crystals of hyposulphite of soda, which will at first form a brown precipitate, but which redissolves if sufficient hyposulphite has been employed. The solution may be used by simply dipping a sponge in it, and rubbing it over the article to be coated. A solution of gold may be made and used in the s me manner. W. J. A.

EXCHANGES.

In this column yearly subscribers who may wish to *exchange* tools, apparatus, books, or the products of their skill, can state what they have to offer and what they want, *without charge*. Buying and selling must, of course, be carried on in the advertising columns.

A small steam engine in good order, cost $1.50, for a dark (bulls-eye) lantern. Geo. H. Umbach, 139 Ross street, Brooklyn, N. Y.

Wanted, a set of wood engraver's tools; Spencer's Psychology, two volumes, given in exchange; also other books for exchange. T. S. Price, Slack's Cañon, Monterey Co., Cal.

Wanted, small turning lathe about 1½ by 12 ins.; state what is wanted in exchange. D. Abrahams, 195 East Broadway, New York.

Globe microscope, magnifies 100 diameters, cost $2.50 to exchange for a book on shorthand, or offers. George R. Simpson, Janesville, Bremer Co., Iowa.

Wanted, back numbers of the "American Naturalist;" will give "Harper's" or "Scribner's" monthly. —— Hulbert, 131 West Fifty-third street, New York.

Wanted, a 5 by 8 stereoscopic camera box; Fleetwood scroll saw, nearly new in exchange. L. L. Roberts, 1,203 Arch street, Philadelphia, Pa.

Wanted, good microscope and Vols. I and II of "American Journal of Microscopy, or thorough works on botany; thorough instruction in shorthand, by mail, in exchange. T. S. Price, King's River, Cal.

Wanted, in exchange for books, a second-hand aquarium. Address P. O. Box 124, Bridgeton, N. J.

A collection of postage stamps for small cannon or small printing press; will pay difference. C. L. Hackett, lock box 2,210, Roanoke, Ind.

To exchange a good magic lantern, painted slides, cost $8, for a music box of same price, in good order. L. D. Snook, Barrington, Yates Co., N. Y.

McAllister's Household microscope and American Agriculturist microscope, for small 5 or 6 inch turning lathe, or offers. J. Frank Weaver, Brooklyn, Conn.

Graham's Handbook, Synopsis, and 1st and 2d Readers Standard Phonography; tools or advanced scientific books preferred in exchange. E. H. Bidwell, Vineland, N. J.

Complete outfit for stamping key checks, worth $10, in exchange for practical receipt books, or bracket saw with lathe and drill attachment. John Whitty, Jr., Polloksville, N. C.

Woodward's Hospital Microscope wanted in exchange for chemical scales and weights; difference in cash. J. Siler, 1,212 Broadway, St. Louis, Mo.

For exchange, an entire printing outfit, cost $50; state what you have to exchange. F. R. Miller, 750 East Fourth street, South Boston, Mass.

Good $50 job printing press, in perfect order, for a scroll and circular saw, or scroll saw alone; saw must be in good order. Samuel J. Jones, Box 137, Oxford, N. C.

Wanted, foot power scroll saw, lathe, or both combined, or good microscope, for minerals, books on plant culture, Art Journal in parts, or cancelled postage and revenue stamps. D. S. Kimball, 48 Exchange Place, New York.

Wanted, small steam engine and boiler of from 1 to 2 horse-power; state what is wanted in exchange. Address Jno. McElvery, Flatbush, L. I.

Wanted, telegraphic and mathematical instruments; Pitman's Phonography in exchange; also thorough instruction in same by mail. F. S. P., King's River, Fresno County, Cal.

A set of chemicals and apparatus; also a set of wood engraver's tools, glass and instruction book, to exchange for a scroll saw and a microscope. The chemicals and tools cost nearly $40; will give a good trade. F. H. Jackson, Angelica, N. Y.

Wanted, a copy of Holtzapfel's "Mechanical Manipulation." State what is wanted in exchange. E. W., Box 4875, New York.

Wanted, a small turning lathe in exchange for a pair of telephones. J. C., care YOUNG SCIENTIST.

Scroll saw wanted in exchange for handsome portfolio of six water color sketches. Address F. S., care Box 4875, New York.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. H. A. Cutting, State Geologist, Lunenburgh, Essex County, Vt.

Wanted, complete Lester combination scroll saw in good condition; books in exchange. J. T. Jackson, Box 48, Metuchen, N. J.

Gold watch (cost $150) in exchange for a good microscope. E. W., Box 4875, New York.

Wanted, microscope, or scientific and mechanical books and apparatus, in exchange for printing press, cost $21, with or without type and material. J. P. Burbank, Salem, Mass.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL FOR AMATEURS.

VOL. I. NEW YORK, OCTOBER, 1878. No. 10.

Wood-Carving.

THE art of carving wood is one that is very fascinating, and, at the same time, very easily learned. Indeed, many ladies have adopted it as a recreation, and have thus been enabled to add greatly to the numerous articles of *vertu* which ornament the parlor and the boudoir. Some branches of the art are exceedingly simple, requiring but a few hours and the employment of the simplest tools, to enable even a beginner to turn out very respectable work. On the other hand, some departments of the same employment require for their successful pursuit the highest skill of the sculptor and the artist; and thus there is abundant room offered for the exercise of the very highest talents, while even those of very ordinary abilities will find no difficulty in securing that success which alone can confer enjoyment. In this respect, wood-carving differs from many merely routine operations, in which differences of skill are hardly appreciated. The most talented and skilful may find full scope for their abilities, while even the least ingenious will find that they can actually accomplish respectable work. We therefore propose, in the following articles, to give such simple yet complete instructions as will enable any smart boy or girl to take up the art, and pursue it as far as their abilities will allow.

The first thing to be provided is a proper set of tools, and fortunately these are neither numerous nor expensive. Here is an ample list for a beginner: three chisels—eighth, quarter and half-inch; three flat gouges, do.; three deeper gouges, do.; three half-round, do.; one V, or parting tool; one sken, or corner-chisel; one mallet; two cramps for fastening the work to the table; one oil-stone; one slip; one brace and bit, for boring holes; two fine gimlets; two punches—one star and the other checquer; one tracing-point; a small glue-pot; a few small files; and a hammer. The cost of the entire outfit is but a trifle; and many of the tools—such, for example, as the brace and

bit and the hammer—may be found in the tool-chest of most ingenious boys. In making the purchases, however, beware of what are called "boy's" tools. They are cheap and pretty, but the material and temper are not what is required. Go, therefore, to some respectable hardware shop, and purchase such tools as are sold to mechanics—with good large handles, and finely though not fancifully finished—and you will have a set of really much more serviceable tools than any assortment that is

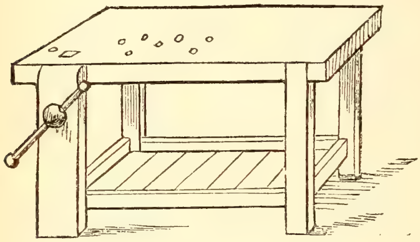


Fig. 1.

usually put up for amateurs. A few of the tools—including the punches and the V or parting tools—can be had only from houses that deal in wood-carver's tools, but they may be ordered through any hardware merchant.

Any good stout table will answer for a work bench; but if you can procure a bench as made in the engraving (Fig. 1) it will greatly facilitate your operations. It should

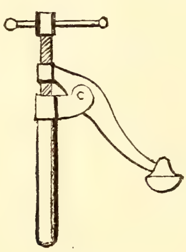


Fig. 2.

be at least forty inches long by twenty-four wide, with a bench-vice at one end, and a tray at the further side to hold the tools. The thickness of the bench should be at least two inches, and it should be as firm and as solid as it can be made. It should be high enough for you to stand up to your work; and have holes bored through at convenient distances, in three rows, to insert the hold-fast, of which a sketch is given (Fig. 2). The hold-fast is put into one of the holes, the work to be held is put under the pad, and the screw is turned until the work is firmly fixed. This hold-fast is used when the wood to be carved is too thin for the carver's screw to be inserted into it, and when it is not desirable to glue it down on another board. In using this hold-fast, we always put a piece of some soft wood between the pad and the wood that we are carving, so as to prevent the teeth of the pad from marking it. It is not difficult to see that a deep scratch might interfere sadly with the delicate part of some leaf. Instead of the hold-fast, the carver's screw, which is better, may be used. It all lies below the table, and there is nothing in the

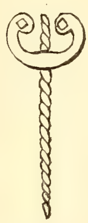


Fig. 3.

way of the carver. This screw, with its nut or clamp, is shown in Fig. 3. To use it, remove the clamp, grasp the screw in the bench vice between two scraps of wood, so as to save the jaws of the vice; screw the upper or sharp point into the block to be carved; pass the screw down through the bench, and then, by means of the clamp or nut, make it fast. Where the block is very thin, it should be glued to a thick block, a thickness of paper being glued between the two to facilitate their separation, as will be hereafter described.

The bench that we use is a compound of a carver's and joiner's bench, and we can strongly recommend it to all amateurs who

can afford to have one made; for, after having carved your work, you can joiner it, and you can plane and prepare your own wood, and be thus independent of the carpenter, which is most desirable. Our bench is of the following dimensions: Length, 4 feet 5 inches; breadth, 3 feet 1 inch; height, 3 feet 1½ inch. The wood is oak, three inches thick, and there are three rows of holes for the hold-fast. There are only two holes in each row; the centre of the holes of first row, three inches and a half from the edge, and fourteen inches from head of bench. There is the usual bench-stop, or dog, and the bench-vice is of the ordinary pattern, which may be procured at any hardware store, and is easily fitted up.

To be continued.

How to Make an Herbarium.

BY JOHN W. BUCK, B. SC.

Concluded from page 117.

TO mount the specimens, lay them on a sheet of brown paper or newspaper, gum them carefully all over the back, and then lay them gently on the white sheet in the best position, which you should have previously decided on, and press them down with a clean handkerchief. Use no more gum than is absolutely necessary, and wipe away any excess at once. A good plan with a very large or weak plant is to gum the back of the stem, fix it by a gentle pressure, and then turn up the leaves and flowers one by one, gum them, and then lay them back again in position. Another method, which I remember trying once with a long trailing pimpernel, and which succeeded well, was to gum it on the back as before; shift it, still face downwards, to a sheet of brown paper the same size as that on which I was going to mount it, arrange it as I desired, and lastly turn the white sheet down over it. On lifting it up, it of course brought the specimen away with it. The delicate blossoms which have been separately dried should next be placed in their natural position, care being taken to hide any awkward appearance of a join in the stem. Long plants, too long to lie on one sheet, should be cut in two pieces, and these laid side by side; and if the stem be very long and a piece of it be permanently removed, the cut ends should not be brought close together, but it should plainly appear that a piece of the stem is absent. All parts of the plant should be shown as far as they can, and on the same sheet. For instance, somewhere on the dandelion sheet should be shown the globular downy seed-head, and with the strawberry plant the strawberry fruit itself, which latter, notwithstanding its succulent nature, may be easily dried, if not too ripe to begin with. These should not be made to appear as if growing from the same plant as in flower unless they were actually found so growing. In fact, in mounting such parts, nature must be imitated, not contradicted. A few slips of well-gummed paper of the same kind as that you are mounting upon, should be kept at hand, with which to fix down stiff stems, which often have a tendency to part company with their sheets.

Labeling should be done immediately after mounting. To keep the names, localities and dates of the plants while pressing, the particulars may be written on small scraps of paper, which must be transferred each time with the respective specimens whenever the sheets are changed. I have found this plan answer best in practice, as, if the entries are made in a note-book, there is a danger of afterwards mistaking one plant for another. But however these facts are preserved, as soon as a specimen is fairly mounted, they should be transferred to the right-hand bottom corner of the permanent sheet. They may be written thus:

Rhinanthus Crista-galli,
(Yellow-rattle),
Hayfields, near Freshford,
10. 6. 78.
(Collector's name.)

Or printed labels may be obtained with spaces to be filled up. After mounting and labeling, the sheets should be again pressed flat for a day or two.

But the young botanist who does not wish to have a good deal of trouble thrown away, and to see his well dried specimens devoured by insects, has more work before him yet. Mould is not likely to trouble him with plants which have once been made completely dry. A botanical friend, to whom I am indebted for several of these hints, writes: "At one time, in the very wet summer of 1875, and when I had my press so full that scarcely more than two sheets were between plant and plant, I found, to my disgust, many of them moulding. But I took heart, and brushed off the mould with a moderately stiff brush continually, till they were thoroughly dry, and then stacked them away between dry sheets, and did not look at them again till nine months afterwards, when I found them without a particle of mould. Later on, I cured some of the mould by brushing it off and washing the plants with corrosive sublimate, while they were still in the press. But, by pressing few at a time, and by using more paper, I might, of course, have escaped that; and it does not do to trust to being able to get rid of the mould so, for it discolors the specimens." But all plants are more or less liable to the attacks of insects, and some, as the *Ranunculaceæ*, *Cruciferæ*, and *Umbelliferæ*, especially so. The best preventive is corrosive sublimate. The Rev. Gerard Smith recommends dipping *Ranunculaceæ* (buttercups) and *Cruciferæ* (shepherd's purse, cuckoo-flower, etc.) before pressing, into a saturated solution of corrosive sublimate in equal parts of rain water and methylated spirits. A more convenient plan is to paint the specimens with the liquid after they are mounted. For this purpose a solution should be made of one-quarter of an ounce of the sublimate in half a pint of methylated spirit (not "methylated finish,") which is to be applied to the specimens with a pretty stiff brush, taking care that it penetrates all corners and crevices. Every plant should be treated in this way, as it not only prevents the attacks of insects in the future, but entirely destroys any animal life that may be already there. The sheets are then to be again subjected to pressure for twelve hours, after which they will be ready for the herbarium.

It only remains now to arrange the specimens in proper order, but as it is unnecessary to do this until a large number have been collected, we will leave the consideration of it at present. Meantime the sheets should be laid flat in a box, secured from dust, kept in a dry place, and not exposed to the light more than necessary.—*Science Gossip.*

How to Study Entomology.

BY F. C. SMITH.

IV.

Continued from page 105.

INSECTS are divided by most naturalists into nine orders. These orders are again divided into families, and the families into species.

The orders are as follows: *Aptera*, *Diptera*, *Hemiptera*, *Lepidoptera*, *Orthoptera*, *Hymenoptera*, *Thysanoptera*, *Neuroptera* and *Coleoptera*.

Insects of the order *Aptera* are wingless, and embrace fleas, lice, etc. All insects which suck their food, and possess but two membranous wings are called *Diptera*. Most insects of this order have two very minute appendages, in the absence of the second pair of wings, called poisers, their duty being to regulate the flight of the insect. The *Hemiptera* are four winged, in some species membranous, and in others the upper wings are of a harder consistency than the lower. The order *Lepidoptera* embrace the insects commonly known as the butterfly and moth. These insects are remarkable for their beautiful colors, and are found in great variety in all parts of the world. They undergo three complete transformations. Cockroaches, locusts, grasshoppers, crickets, etc., are of the order *Orthoptera*. The anterior wings are usually long, narrow, and half horny, and serve only as a protection for the secondary wings, which are more delicate and used for flying only. The metamorphoses

of this insect is incomplete. Those insects having four membranous naked wings lying horizontally upon the body are embraced in the order *Hymenoptera.* Bees, wasps and ants are of this order, and undergo a complete transformation. The *Thysanoptera* have not received much attention from naturalists, there being but few insects of this order yet discovered. The *Neuroptera* is an order comprised chiefly of dragon flies, and presents the greatest number of modifications of form of any order known. The easiest preserved order is the *Coleoptera,* and in large collections this order usually holds the first place. About one hundred and thirty thousand species are already found, and constant additions are made to this order, which embraces beetles of all kinds.

The orders *Coleoptera* and *Lepidoptera* are almost sure to be the first to attract the attention of the young student, and in a brief review we will consequently notice these orders before taking up the others.

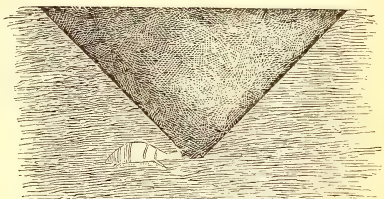
Let us first examine a caterpillar, which is an imperfect insect of the order *Lepidoptera.* We will find the body to be composed of twelve segments or parts. First is the head, containing the mouth and six simple eyes. Next comes the three segments which are to constitute the thorax of the perfect insect, be it moth or butterfly, containing the six true legs. The rest of the segments constitute the abdomen. The legs on these parts are not true legs, but simply organs of locomotion, armed with minute hooks, by which a firm hold is obtained to a twig or leaf. Nearly all caterpillars feed on plants, the exceptions being those that infest our furs and woolen fabrics. After attaining its full growth, the caterpillar ceases to eat, and prepares for the wonderful change that is about to take place. The intestinal canal is emptied of all vegetable matter, and its colors lose their brilliancy. The pupa state is now entered upon in one of three manners, depending on the species: either by suspending itself by the tail to a leaf or branch, and by a series of convulsions, emerging a chrysalis; or by spinning a cocoon of silk around itself, and undergoing the change inside the cocoon; or by burrowing in the soft earth and entering the pupa state underground. These astonishing and wonderful changes will form the most attractive and instructive department of the study of the insect world.

To be continued.

The Ant Lion.

IN a recent number we gave an account of the very singular method by which the archer fish secured its prey. Amongst the hunters of this class, the ant lion occupies a prominent position, and an account of it cannot fail to interest our readers.

This ravenous little insect is endowed by nature with superior intelligence, and displays great skill and cunning in the entrapping and securing of its prey. Having determined upon a suitable site, generally a clear sandy space under the shade of some shrub or boulder, it begins the construction of a minature pitfall by first thrusting



THE ANT LION.

its long jaws and flat head underneath the grains of sand, and then by a sudden upward jerk tossing them several inches beyond the edge of the pit. This operation is repeated until a funnel-shaped hole is excavated, as shown in the plate, the sides of which are as steep as the shifting nature of the sand will allow.

When completed, the ingenious little builder conceals his body at the bottom, leaving only the extended jaws exposed. Here he awaits patiently until the unconscious victim, generally some smaller insect, approaches the edge of the ambuscade,

when the disturbance of the sand above warns the watcher below, and he begins to toss up the earth from beneath the unwary ant or beetle, thus deepening the hole, and causing the sand on the shelving sides to slide down toward the centre, bearing with it the prey to within reach of the extended jaws. The lower sides of these are provided with tubular channels, that serve as ducts to convey the blood of the victim to the mouth of the captor. After sucking the body dry, the carcass is tossed beyond the limits of the pit, which is at once repaired, and made ready for the approach of a second visitor.

Simple Lessons in the Art of Photography.

FIXING SOLUTIONS.

Continued from page 119.

THE last important solution used in photogrophy is the fixing solution. Without fixing solutions, the image invisibly printed by the actinic rays of light reflected from the object, and rendered visible by the developer, would soon fade away and entirely disappear. Experiments indefatigably carried on for more than ten years were required before fixing solutions—the last keystone in the arch of photographical operations—were discovered. The fixing solutions at present in use are: cyanide of potassium and hyposulphite of soda.

Cyanogen does not exist either in a free or combined state in nature; it is a production of decomposition in which the elements contained in it are brought together in the nascent state. It is a gas which, by a pressure of four atmospheres, is reduced to the liquid state of the numerous combinations which it forms. Hydrocyanic acid or prussic acid, and cyanide of potassium, are the most important; the latter of the two is the only one used in photography. The extraordinarily poisonous character of this compound renders its use rather dangerous. Hyposulphite of soda, which possesses the same degree of dissolving power, without the poisonous qualities of the former salt, is obtained by digesting sulphur in a solution of sulphite of soda.

Formula No. 1, (poisonous). Cyanide of potassium, 1 drachm; water, 4 ounces.

Formula No. 2. Hyposulphite of soda, 2 ounces; water, 4 ounces.

The photographic properties of cyanide of potassium and hyposulphite of soda which are called into action, are their power to dissolve the iodide and bromide in the sensitized collodion film, which have not been affected by light. Cyanide is not only a solvent, but also a reducer, a fact which accounts for the whiteness in the silver film when the plate has been fixed by its application. For this reason it is regarded as the fixing agent peculiarly adapted for collodion positives; whereas in the negative, where the whiteness of the silver film is of little or no consequence, hyposulphite of soda is regarded as the proper fixer.

Negatives fixed by the latter salt require a very thorough washing, since if any trace of it is left in the film, the image will be destroyed by crystallization taking place on its surface.

How to Sharpen a Screwdriver.

IN driving a screw into wood, the force used to press the screwdriver against the head of the screw, tends to aid the latter in penetrating the wood, but when we attempt to extract a screw, every pound of pressure that we apply tends to render it more difficult to get the screw out. It therefore becomes very important that the screwdriver should be so formed that it may be kept in the nick of the screw by the exertion of the very least degree of force; for if it has any tendency to slip out, we can keep it in place only by applying pressure, in which case we run great risk of injuring the nick and rendering it impossible to draw the screw. If we examine a screwdriver in the condition in which it is ordinarily found, we shall find that it presents a section like that shown in Fig. 1, in which the sides of the wedge, in which all screwdrivers terminate, are curves with the convex sides outwards, Now, the effect of

thus curving the sides of this wedge, is to render it greatly more obtuse. Moreover,

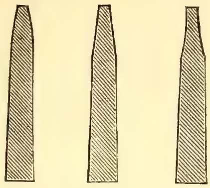


Fig. 1. Fig. 2. Fig. 3.

when we turn the screwdriver, the tendency to slip out of the nick is just in proportion to the obtuseness or bluntness of the wedge, and therefore this form is the very worst that can be chosen. In the hands of most good workmen, therefore, we find that the screwdriver ends in a wedge of which the sides are perfectly straight, like Fig. 2. This is a very good form, but is not equal to Fig. 3, in which the sides of the wedge are curves, but with the *concave* sides turned outwards. In this way we lessen the obtuseness of the wedge at the extreme point, and produce a turnscrew which may be kept in the nick by the least possible pressure endwise. To grind a screwdriver into this form, it is necessary to use a very small grindstone, and many of the artificial stones found in market answer admirably. Amateurs would find it to their advantage to keep one of these small grindstones for this and similar purposes, as it can be run in the lathe with very little trouble.

The Effect of Politeness.

A BRAVE, active, intelligent terrior, belonging to a lady friend, one day discovered a monkey belonging to an itinerant organ-grinder, seated upon the bank within the grounds, and at once made a dash for him. The monkey, who was attired in jacket and hat, awaited the onset with such undisturbed tranquility that the dog halted within a few feet of him to reconnoitre. Both animals took a long, steady stare at each other, but the dog evidently was recovering from his surprise, and about to make a spring for the intruder. At this critical juncture the monkey, who had remained perfectly quiet hitherto, raised his paw and gracefully saluted by lifting his hat. The effect was magical; the dog's head and tail dropped, and he sneaked off and entered the house, refusing to leave it till he was satisfied that his polite but mysterious guest had departed. His whole demeanor showed that he felt the monkey was something "uncanny," and not to be meddled with.—*Nature.*

To Remove Tight Stoppers.

To remove glass stoppers when tightly fixed, it has been recommended to apply a cloth wet in hot water. This is an inconvenient and frequently unsuccessful method. The great object is to expand the neck of the bottle so as to loosen it on the stopper. If, however, the latter be heated and expanded equally with the former, the desired effect is not produced; and this is often the case in applying hot water. By holding the neck of the bottle about half an inch above the flame of a lamp or candle, for a few seconds, we have never failed in the most obstinate cases. The hands should be wrapped in a towel, and great care should be taken not to let the flame touch the glass, as this might cause it to crack. The bottle should be kept rapidly turning during the operation, so as to bring all parts of the neck equally under the influence of the heat, when it will be rapidly expanded, and the stopper may be withdrawn by a steady pull and twist. Following this plan, we have never failed once out of hundreds of attempts. When the bottle contains alcohol, benzine, ether, or similar inflammable liquids, great care must be taken lest the stopper should come out suddenly, and the contents of the bottle take fire.—*Amateur's Handbook.*

Preserving the Colors of Pressed Plants.

The following process is said by the London *Chemist and Druggist* to give very excellent results: Dissolve one part of salicylic acid in 600 parts of alcohol, and heat the solution to the boiling point in an evaporating dish. Draw the plant slowly through the liquid, wave gently in the air to get rid of superfluous moisture, and dry between folds of blotting-paper several times repeated. In this manner the plants dry rapidly, which is a great gain, and they thus furnish specimens of superior beauty.

The Heavens for October.

BY BERLIN H. WRIGHT.

THE computations in the following are made for the meridian of New York city, and are expressed in mean or clock time:

How to Find and Recognize the Major Planets and their Telescopic Appearance.—The major planets should always be looked for in the Zodiac, a belt extending 8° on each side of the sun's path. The only ultra-zodiacal planets are the asteroids or minor planets, which are invisible to the naked eye.

The planets, unlike the stars, come into view at no particular season of the year, and are almost constantly changing their position among the stars, advancing or moving eastward, and apparently retrograding or moving westward at different times. There are times, however, when they do not change their position, relative to the stars, for several days, owing to the fact that their motion in orbit is then in the direction of the line of vision. Hence, if upon observing a body in the Zodiac for several successive evenings, we find it changing its place with respect to the neighboring stars, it must be a planet or comet. This method will only apply to Mercury, Venus and Mars. The motion of Jupiter, Saturn and Uranus past the stars being too slight to be easily observed, while Neptune is invisible to the naked eye.

There are nine major planets, including the newly discovered intra-Mercurial planet and the earth, and 186 minor planets. We will mention them in their order outward from the sun.

Vulcan can only be seen during an eclipse of the sun, darkening the sky in its vicinity, and then only with the aid of a telescope.

Mercury is so close to the sun that he can only be seen either during a solar eclipse and near greatest elongation, *i. e.* when his angular distance from the sun is greatest. Even when the elongation is greatest, he can not always be seen, owing to the fact that he is south of the sun part of the time, and consequently his altitude (perpendicular distance above the horizon) at sunrise or sunset would be much less (for the same amount of elongation) than when north of the sun.

When brightest, there are few stars that equal him in brilliancy. At a recent conjunction of Jupiter and Mercury, it was impossible for us to identify them by any difference in brilliancy.

To the amateur telescopist Mercury presents but few features of interest. A telescope of very moderate power will show his phases. His phase when brightest, is generally very slightly more than a half-circle. He will be brightest Sept. 28, rising at 4h. 27m. morn—1h. 26m. before the sun, and 6 minutes after the beginning of twilight—about 8° north of the sunrise point. He will be in conjunction with Venus Sept. 30. Their conjunction in right ascension occurs about 9 o'clock in the morning, and as Mercury has at that time the greatest apparent eastward motion in R. A., he will, when first seen, be east of Venus. Venus will be the brighter, and south of Mercury about one-fourth of a degree. He will not be visible again until December.

Venus, to the eye, is the most beautiful of the planets, but when viewed with a telescope sadly disappoints the observer, especially if a high power be used and the instrument is not approximately achromatic. When brightest she may be seen with the naked eye at noonday.

Any ordinary telescope or good opera glass will show her large crescent when brightest, and a little better instrument will show all of her phases.

She is a morning star, remaining such until Dec. 5, when she reaches superior conjunction. Hence she now presents a large gibbous phase, or is nearly full, as we apply the term to the moon. She rises as follows:

1st—4h. 33m., morning.

10th—4h. 57m., morning.

20th—5h. 21m., morning.

30th—5h. 45m., morning.

We have only mentioned the inferior planets, or those situated between the earth and sun. Next month we will conclude this description.

Penn Yan, N. Y., Sept. 4, 1878.

Microscopy.

A Common Microscopic Object.

AMONGST the most common, as well as the most interesting of microscopic objects are the bell-shaped animalcules (*Vorticella nebulifera*). They are to be found in almost every pool of water, and, indeed, in every old bucket used to draw water from wells and cisterns. They are therefore amongst the first objects which present themselves to young microscopists, many of whom, when they first see them, think they have discovered a new organism of rare and surpassing beauty, for they cannot see how a creature so exquisite and interesting can be known at all, and yet not be known to everybody. Those who desire to study the life history of these curious creatures, will find a pretty full account of them in Gosse's "Evenings with the Microscope," and in Carpenter's treatise. It requires no great power to see the animalcules themselves, or even to detect the curious wheel-like motion of their cilia, by means of which they obtain their food, but to see the cilia themselves, that is, the little hair-like processes which are seen to fringe the mouths of the bell-shaped cups in the engraving, requires a good glass. The word *cilia* means literally *eye lash,* and these lashes when put in motion create a sort of whirl-pool or vortex, which sucks in any little floating particles, and carries them into the interior of the animalcule, any nutriment that they may contain being absorbed, and the insoluble parts rejected. These cilia are put in motion one after the other in a continuous round, and this gives an optical appearance exactly like the motion of a wheel. A similar effect in another and nearly allied organism, has given it the name of the *wheel animalcule.* These little creatures are very sensitive, and the least jar produces a curious effect upon them. They at once stop all motion, and the long stalk upon which they are mounted instantly contracts, assuming the spiral form seen in two of the individuals shown in the engraving. After a short time they again begin to expand, the wheels resume their motion, and the process of feeding goes on as before. No one ever sees this object for the first time without being enchanted with it.

GROUP OF BELL-SHAPED ANIMALCULES (*Vorticella Nebulifera*).

THE

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A Liberal Offer.

AS an acknowledgment of past liberality on their part, and an incentive to future efforts on our behalf, we shall give his own copy for 1879 free to every subscriber who is now on our books and who will send us the names of two new subscribers and $1.00. That is to say, we will, to each of our present subscribers, give three copies for one dollar.

What we are Doing.

WE give in this number the first of a series of notes on the celestial objects that may be seen during the following month. This will enable our young friends to watch the bright winter skies with a deeper interest than even their extraordinary beauty can call forth. We also begin a series of articles on wood-carving, which we think will enable many of our readers to take up an art which in some departments is quite simple and easily learned.

Next month we shall, in addition to other valuable matter, give the first instalment of an article on Modeling in Clay, by Miss Samuels. This article will surprise many of our readers by its simplicity. Modeling in clay is generally regarded as a very difficult art, and one requiring a long apprenticeship before even the most commonplace results can be attained. Miss Samuels shows how, even from the beginning, very fair work may be turned out by a little patience and care.

As we stated some months ago, it requires considerable time, and a great deal of labor and money to bring a journal like ours up to the ideal which we have set before us. No other journal of the kind has ever been published to our knowledge, and consequently there is nothing which we can take for a pattern. But from the liberal encouragement which we have received, we feel assured that there is a well-defined want for such a periodical, and we are determined to use our best endeavors to supply it.

Laboratory & Workshop

Hints on Filing.

Preparing Work.—The corners or thin edges of iron castings are very likely to become chilled, and a thin scale or skin produced over the entire surface of the casting, caused by the hot metal coming in contact with the moist sand of the foundry moulds; this outer skin is usually much harder than the metal beneath it, and many times the thin edges or corners are chilled so as to be harder even than the file itself.

The necessity, therefore, of removing this scale and chilled surface, becomes readily apparent, and all mechanics who give any consideration to the proper and economical use of the file, will be careful to see that the scale and sand are first removed by pickling, and the surfaces which have become chilled, by grinding, before applying the file.

Pickling the Work.—The pickle for gray iron castings is generally made by mixing sulphuric acid and water, in the proportion of two or more parts of water to one of acid, and is usually kept for this purpose in a trough lined with lead.

The articles to be pickled are sometimes immersed in this bath, where they are allowed to remain for a short time; they are then removed, and the acid is allowed to act upon their surfaces until the scale is loosened, when they are washed off with water. More often, however, the pickle is dipped from the trough, and poured over the castings, which are placed on a sloping platform (thus allowing the acid to return to the trough), where, after remaining for a sufficient time, they are then washed. When dry, the castings are either rattled, or scraped and cleaned with old files and wire scratch-brushes, until the surface is freed from scale and sand.

To pickle brass, or gun-metal castings, a mixture of nitric acid and water may be used, in the proportion of, say one part acid to five of water, the treatment being the same as that of the iron castings. While not in general use upon the coarser kinds of brass work, the pickle is desirable for smaller castings, or those requiring to be protected with lacquer.

When Oil should not be Used.—All files, when they leave the manufactory, are covered with oil to prevent them from rusting. While this is not objectionable for many uses to which the file is put, there are cases where the oil should be thoroughly removed, as when the file is to be used in finishing the larger cast iron surfaces, which are of a glassy nature, the principal difficulty being, to make the file "bite," or keep sufficiently under the surface to prevent glazing; otherwise the action not only hardens or burnishes the surface operated upon, but dulls the extreme points of the teeth, thus working against the desired end in both directions.

When Oil may be Used.—Oil may, however, be used to good advantage on new files, which are put immediately to work upon narrow fibrous metals of a harder nature; in such cases, it is not uncommon, with good workmen, to fill the teeth with oil and chalk.

Oil is also useful on fine files, in the finishing of wrought iron, or steel, as by its use the teeth will not penetrate to the same degree, and the disposition to "pin," and scratch the work, is materially less than when used dry.

Cement for Stone or Marble.—The best cement for mending marble or any kind of stone, is made by mixing 20 parts of litharge and 1 part of freshly burned lime in fine dry powder. This is made into a putty by linseed oil. It sets in a few hours, having the appearance of light stone.

To Make Sailcloth Impervious to Water, and yet Pliant and Durable.—Grind 6 lbs. English ochre with boiled oil, and add 1 lb. of black paint, which mixture forms an indifferent black. An ounce of yellow soap, dissolved by heat in half a pint of water, is mixed while hot with the paint. This composition is laid upon dry canvas as stiff as can conveniently be done with the brush. Two days after a second coat of ochre and black paint (without any soap) is laid on, and, allowing this coat time to dry, the canvas is finished with a coat of any desired color. After three days it does not stick together when folded up. This is the formula used in the British navy yards, and it has given excellent results. We have seen a portable boat made of canvas prepared in this way and stretched on a skeleton frame.

Harmless Pharoah's Serpents.—Many of our readers have seen, and no doubt been amused with the little balls sold as "eggs of Pharoah's serpents," which, when ignited, turn into a long twisted rod of fused ashes, having a striking resemblance to a snake. Unfortunately the materials of which they are made are highly poisonous, and the fumes, being mercurial, are also dangerous. The following mixture is nearly as good, can be had anywhere, and is quite free from danger: Mix intimately together two parts of bichromate of potassa, one part of nitrate of potassa, and three parts of white sugar. This mixture should be pressed in paper or tinfoil cones, and, if intended to be kept for any length of time, the paper should be varnished over with sandarac varnish. A small quantity of balsam of Peru may be added to perfume the mixture, so as to cause its combustion to be attended with a pleasant odor. The greenish-colored very porous mass, which assumes the serpent shape, is a mixture of carbonate of potassa, oxide of chromium, carbon, and a small quantity of neutral chromate of potassa. We have tried this recipe with very satisfactory results.

Inquiries and Answers.

Inquiries.

38. What is the composition used for making electrotype moulds? How are the moulds taken from the type? A. W. P.

39. Can any of your readers furnish directions for dissecting the abdomen and internal organs of the spider? Taylor, formerly State Entomologist of Georgia, speaks of a mould being taken by dropping melted suet therein, but does not give process. ENTOMOLOGIST.

Answers.

40. In answer to B. G. P. (36), the acid used in engraving upon steel is nitric (poison). The best method of applying it is as follows: Clean the part to be engraved upon, then pour over this a thin layer of melted wax; allow it to harden, and scratch on the wax the name or device with a pin, so that wherever the pin has been the surface of the object to be engraved is free from wax; now with a little stick, bruised so as to look like a little brush, apply the acid over the wax, allowing it to eat the iron or steel in the lines made by the wax; ten minutes will be sufficient to engrave the work; then wash and remove the wax. J. C.

41. In answer to B. G. P. (36), first clean the blade of the knife thoroughly, and then apply a coating of beeswax to the blade, being careful to get the whole surface covered. Then cut the name in the wax, being careful to remove the wax from the blade wherever the etching is required, after which apply strong muriatic acid for a few seconds, and then wash thoroughly in water. SUBSCRIBER.

EXCHANGES.

In this column yearly subscribers who may wish to *exchange* tools, apparatus, books, or the products of their skill, can state what they have to offer and what they want, *without charge*. Buying and selling must, of course, be carried on in the advertising columns.

Hamilton, Up. Held. and Carboniferous fossils; also eastern minerals, to exchange for fossils, minerals, shells, or Indian relics; list of duplicates and desiderata sent upon application. B. H. Wright, Penn Yan, N. Y.

To exchange, 2-column adding machine, American Manual of Phonography, collection of foreign stamps and Confed. money, books, and files of illustrated and literary papers, for printing material or press; or for spy or opera glass. J. N. Huston, Box 108, Chase City, Va.

Minerals, fossils, Indian relics, shells, woods, fossil woods, skulls, etc., to exchange for type, sea shells, fossils, foreign coins and stamps. Frank M. Farrell, Box 37, Cobden, Ill.

Great variety of good wood cuts to exchange for good compound microscope, in good condition, of at least 200 diameters. Austin Cravath, Whitewater, Wis.

Bohn's first lessons on Geology, Mineralogy and Fossil Botany, and pair of American Club Skates, given in exchange for a German silver fife and instruction book. Thos. F. Sheridan, Bridgeport, Ct.

Gold watch (cost $150) in exchange for a good microscope. E. W., Box 4875, New York.

Asmall steam engine in good order, cost $1.50, for a dark (bulls-eye) lantern. Geo. H. Umbach, 139 Ross street, Brooklyn, N. Y.

Wanted, a set of wood engraver's tools; Spencer's Psychology, two volumes, given in exchange; also other books for exchange. T. S. Price, Slack's Cañon, Monterey Co., Cal.

Wanted, small turning lathe about 1½ by 12 ins.; state what is wanted in exchange. D. Abrahams, 195 East Broadway, New York.

Wanted, back numbers of the "American Naturalist;" will give "Harper's" or "Scribner's" monthly. —— Hulbert, 131 West Fifty-third street, New York.

Wanted, a 5 by 8 stereoscopic camera box; Fleetwood scroll saw, nearly new in exchange. L. L. Roberts, 1,203 Arch street, Philadelphia, Pa.

Wanted, good microscope and Vols. I and II of "American Journal of Microscopy, or thorough works on botany; thorough instruction in shorthand, by mail, in exchange. T. S. Price, King's River, Cal.

A collection of postage stamps for small cannon or small printing press; will pay difference. C. L. Hackett, lock box 2,210, Roanoke, Ind.

To exchange a good magic lantern, painted slides, cost $8, for a music box of same price, in good order. L. D. Snook, Barrington, Yates Co., N. Y.

McAllister's Household microscope and American Agriculturist microscope, for small 5 or 6 inch turning lathe, or offers. J. Frank Weaver, Brooklyn, Conn.

Graham's Handbook, Synopsis, and 1st and 2d Readers Standard Phonography; tools or advanced scientific books preferred in exchange. E. H. Bidwell, Vineland, N. J.

Complete outfit for stamping key checks, worth $10, in exchange for practical receipt books, or bracket saw with lathe and drill attachment. John Whitty, Jr., Polloksville, N. C.

Woodward's Hospital Microscope wanted in exchange for chemical scales and weights; difference in cash. J. Siler, 1,242 Broadway, St. Louis, Mo.

For exchange, an entire printing outfit, cost $50; state what you have to exchange. F. R. Miller, 750 East Fourth street, South Boston, Mass.

Good $50 job printing press, in perfect order, for a scroll and circular saw, or scroll saw alone; saw must be in good order. Samuel J. Jones, Box 137, Oxford, N. C.

Wanted, foot power scroll saw, lathe, or both combined, or good microscope, for minerals, books on plant culture, Art Journal in parts, or cancelled postage and revenue stamps. D. S. Kimball, 48 Exchange Place, New York.

Wanted, small steam engine and boiler of from 1 to 2 horse-power; state what is wanted in exchange. Address Jno. McElvery, Flatbush, L. I.

Wanted, telegraphic and mathematical instruments; Pitman's Phonography in exchange; also thorough instruction in same by mail. F. S. P., King's River, Fresno County, Cal.

Wanted, a copy of Holtzapfel's "Mechanical Manipulation." State what is wanted in exchange. E. W., Box 4875, New York.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. H. A. Cutting, State Geologist, Lunenburgh, Essex County, Vt.

Drawn and engraved by A. W. Roberts.

See page 137.

ACORN BARNACLES.

The Young Scientist

SCIENCE IS KNOWLEDGE. KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL FOR AMATEURS.

VOL. I. NEW YORK, NOVEMBER, 1878. No. 11.

A Curious Experience with Acorn Barnacles.

SOW often it happens that just when we think we have made ourselves acquainted with the habits of some grotesque little creature, it will turn and play us an unexpected prank, and often after years of delightful study of our aquaria, we discover some strange development in animal or vegetable life which sets at naught our keenest scrutiny, and upsets all our previous conclusions.

Not the least novel of my experiences was the finding, at Maspeth bridge, which spans an arm of Newtown Creek, thousands of full-grown acorn barnacles (*Balanus balanoides*) attached to strips of oilcloth. The latter were waste pieces from an oilcloth factory; they had been thrown into the creek and had become entangled amongst timbers and rocks. The strips were encrusted on both sides with barnacles so thickly in places that the oilcloth was not visible. Eager to secure a good quantity of these little creatures, so strangely fastened, I took away some twenty yards for my own and friends' tanks, and decorated one of my largest tanks in festoons. The effect, however, was neither natural nor pleasing; I therefore determined to detach them, and if possible invent a means of fastening them to some of the numerous rocks contained in the tank. The oilcloth was waterlogged and partially decayed, so that the barnacles came off readily. I made a cement of two-thirds beeswax, nearly one-third resin, and the rest Canada balsam. I then selected some of the flattest stones and slightly warmed them in an oven. I then placed small lumps of the cement on the warm stones, and pressed the barnacles on the warm cement, causing them to adhere with great firmness; the barnacles having been previously well dried in the open air (they can be kept with safety in the open air forty-eight hours). Parts of the cement were visible here and there, and were unsightly: to cover this defect I attached pieces of serpula, and dead buccinums, and small pyrulas.

A quantity of barnacles remaining still unused, suggested further designs, and I procured some long and short cone-shaped pieces of pumice stone, that resembled stalactites, and covered them with barnacles and algæ. In floating these on the surface, my tank had the appearance of a grotto, the effect of form and light and shade being quite novel. The inquisitive "shrimp" (*Palamentes vulgaris*), and quaint little hermit crabs (*Eupagurus longicarpus*), were soon scrambling over the rocks, cleaning the barnacles to immaculate whiteness. To support this increase of animal life, more oxygen was necessary, and more ulva (*Ulva latissima*) was added.

The barnacles did not feel at home immediately, and the little fairy-like hands were not at work for two days. Then the reaching and grasping began, and so rapidly did they devour the minute animal and vegetable life contained in the water that at the end of a day the water was as clear as crystal, and of a light blue color.

Suddenly, one day, a piece of pumice stone began to revolve, and my first thought was that a prawn or hermit crab was somewhere at work on it; then it seemed as if, from some unknown cause, an imperceptible current of water caused it to turn; but I was finally convinced that I was in error. I took the piece of pumice out overnight, and, assisted by a scientific friend, made a more thorough examination. Placing the stone in the tank next morning, it remained motionless, and I concluded that the mysterious power had departed or was destroyed.

The clearness of the water, and inactivity of the barnacles suggested "feeding time," so I ground three small oysters into a paste, diluted with sea water, and dropped it slowly into the tank. Instantly all the barnacles appeared in motion, and three pieces of pumice stone began revolving rapidly.

The mystery of the moving stone was plain; these three pieces were of nearly perfect cone-shape, and well balanced in the water. The barnacles had been cemented on the cones with their cirrhi, or hands, nearly all pointing one way, so that when feeding they struck the water with their rapidly moving hands, causing the cones to rotate.

I determined to mystify some of my scientific friends over this new motor, so preparing a carefully balanced and turned cone, I cemented the barnacles in nearly concentric circles, with their cirrhi pointing one way. At the top of the cone I dug out a small reservoir, and from this I channeled four gutters extending to the circumference of the base of the cone. In this reservoir I placed a quantity of diluted oyster paste, which slowly worked its way down the gutters and dripped into the water, causing the barnacles to work rapidly. To hide away the reservoir and oyster paste, I draped ulva over the base and part way down the sides, also using small fronds and pieces of *sertularia argentia*, *delesseria*, *enteromorpha* and *chondrus crispus*. All combined gave to the cone the effect of a beautiful mass of marine life.

Another curious fact about this pumice stone cone was that during one very cold night the surface water in the tanks froze over, the low temperature of the water causing the air contained in the pores of the pumice to contract. This allowed the water to enter the pores of the stone, causing it to become heavier than the water, and sink to the bottom of the tank. When the temperature of the water rose again, after the sun had shone on it for a few hours, the air in the stone expanded and floated it up again.

This moving stone was always a source of interest and mystery to my friends. The barnacles lived over a year, slowly increasing in numbers. A. W. Roberts.

—The latest novelty is a "barometer handkerchief." The design printed on it represents a man with an umbrella. In fine weather the umbrella is blue, in changeable weather gray, and in rainy weather white. The secret lies in printing this design in chloride of cobalt; but the first washing removes this sensitive chemical, and destroys the barometric properties.

Lessons in Magic.

THERE is a wonderful fascination about Conjuring, or "Magic," as it is commonly called. Old as well as young succumb to it, and I have yet to meet with any one who, having become at all proficient as a conjurer, ever gave it up entirely.

Within the past few years, very many amateur magicians have appeared, and as there are still hosts of other folks anxious to acquire a knowledge of the "mystic art," I propose in this and following numbers of the YOUNG SCIENTIST to give a course of simple "Lessons in Magic," which I trust I shall be able to make clear to all.

I shall endeavor to avoid as far as possible those tricks that require great manipulation, but as no one can ever hope to become any sort of a magician without a knowledge of *Palming*, I shall begin with an explanation of that most necessary rudiment.

To *palm* a coin, ball, or other article, is to hold it concealed in the palm of the hand, and yet leave the hand in such a natural position that the lookers-on will not suspect that it contains anything. Simple as this appears when done by an expert, it requires no little practice to become perfect in it.

Anything, from a gold dollar to an orange, may be *palmed;* but for a beginner, a silver half-dollar is, from its size, the best to practice on.

Take, then, a half-dollar between the tips of the thumb and fore-finger, and, with the aid of the third finger, slide it along the thumb until it reaches the lower part of the fleshy portion; then, by bringing the thumb around a trifle, toward the palm, the coin will be held by the ball of the thumb on one side, and the palm of the hand on the other, as shown in the accompanying illustration, Fig. 1.

There are several other modes of palming, but this is the most useful, and, for the present, it will suffice.

Palming constitutes the stock-in-trade of some of the best conjurers, and by its aid many wonderful effects may be produced, as, for instance: A coin has been borrowed

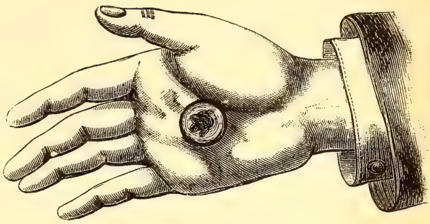


Fig. 1.

for a trick, and the performer hands it to the owner as if to return it. Just as the hand is extended to take it, Mr. Conjurer palms it, and it has disappeared. Some of the audience will imagine it has dropped to the floor, but, to their astonishment, the performer approaches one of their number, and, remarking that "It's really too bad of you, Sir, to play such jokes," apparently takes the missing piece from his beard, hair, or other part of his person. This he does by merely dropping the coin from his palm to the ends of his fingers at the moment that they touch the spot from whence he wishes to take it.

Supposing the student in legerdemain to have practiced *palming* until able to do it well and imperceptibly, he may now pass to a "stage trick," and I will select for this purpose one of the best known to the profession.

The Touch of Midas.—This is a rather fanciful title for what is more generally styled "Catching Money in the Air." The performer borrows a hat, after allowing the audience to satisfy themselves that he has nothing concealed about his arms.

Holding the hat in his left hand, he begins his search for money. He creeps stealthily around the stage, until suddenly, with an exultant cry, he springs forward and catches a coin. He continues picking up money everywhere—in the air, from his own person and from the audience; he shakes it from a lady's handkerchief, and

takes it from a gentleman's beard; everywhere he goes, like another Midas, gold comes at his touch, until at last, tired out, he empties the hat, which he has used as a receptacle for his wealth, before the eyes of the audience, that they may see the treasure he has gathered in.

How is this done? When the performer first goes among the audience both hands are closed, and both contain money; the left hand is filled, and the right holds one piece. In order that the audience may not suspect anything, the tips of the left hand fingers grasp the edge of the lappel of the coat, whilst the right holds his "wand," a short stick, about fifteen inches long, and five-eighths of an inch in diameter, and tipped at the ends with ivory.

Holding the wand in the right hand, the performer requests some gentleman to lend him a hat, and as he receives it, which he does with his right hand, he passes it to his left, which he places inside of it, the thumb only coming outside the rim. The money is now in the hat, and extending his arms, he begs that his sleeves shall be examined. No one suspects the hand, at least I have never heard a word that would lead me to suppose they did. When the examination is over, the performer returns to the stage, and, as he goes to it, throws his "wand" before him to rid himself of it, and at the same moment allows the coin, which has been heretofore concealed in his hand, to drop into his sleeve. Arriving at his stage, he turns his hand to the audience, and shows it is empty. This movement tends greatly to mystify the audience, who, being convinced that neither the sleeve nor the hand contain anything, are at a loss to know where the money comes from. The performer begins his search, and after one or two unsuccessful efforts at catching money "on the wing," he apparently drops his hand despairingly at his side, *and the coin which is in the sleeve falls into his palm*, where he holds it concealed. Now he may commence catching money in earnest. He grasps at the air, and showing between his fingers the coin which he has held *palmed*, the audience suppose he has just caught it. He pretends to throw it into the hat, which is held by the left hand, but in fact *palms* it again, and lets one of the pieces which are in the left hand, drop into the hat. In this way he proceeds, catching, showing and palming the single coin of the right hand, and dropping into the hat, one by one, the coins from the left. When three or four coins only remain in the hand that holds the hat, he again "catches" a coin with the right hand, and this time really throws it into the hat, and, holding up the hand, says, "You see there is nothing concealed here, *nor here.*" As he says this, he passes the hat from the left to the right hand, and placing the fingers of the right hand inside the hat, with the thumb remaining outside, takes the few coins that are left. He holds up the left hand, that all may see it is empty, and then passes the hat back to it, retaining the coins, however, in the right hand, with which he palms them. He then begins again to "catch" the money, letting one coin at a time drop from his palm to the ends of his fingers, and as he "catches" it holds it up to view, and then throws it into the hat, in such a way that all may see him do it. By this little feint, he makes his audience believe that he threw all the coins in, and does away with any suspicion they may have had to the contrary. He now turns the money out of the hat on to a plate, and returns the hat, if he does not need it for another trick.

To be continued.

Wood-Carving—II.

SHARPENING TOOLS.

THE first thing to do is to learn to sharpen your tools. They generally come ready ground from the store, and merely require to be sharpened on an oil-stone. The oil-stone should be set in a block of wood, and fitted with a cover, so as to protect it from dust and dirt, and give it a broad, firm basis, on which to stand. A small particle of hard grit falling on the

stone and remaining there while the tool is being sharpened, will often seriously injure a fine tool, and great care is therefore required in this respect. To keep an oil-stone in good condition, it must be kept clean and free from old gummed-up oil. When the oil becomes thick and gummy, the tool slides over it without being ground away, and your labor is lost. The best kind of oil, in our opinion, is good sweet oil. Some recommend kerosene, but we have found that it hardens the stone and injures it. It is also necessary that the stone for sharpening chisels, etc., should be kept perfectly flat. When it becomes irregular, the best method of making it true is to grind it down upon some flat gritty stone, with water, and afterwards smooth it off by rubbing it over with a flat slate charged with very fine emery. After having cleansed off the stone carefully, put a little oil on it, take one of your chisels, the handle in your right hand, put it on the stone, and holding it at the angle at which it has been ground, place the fingers of the left hand on the face, and with a moderate pressure rub it steadily backwards and forwards, looking at it frequently to see if you do not get it down too much, and make what is called a wire edge. When it is sharp enough, raise your right hand a little, give the edge of the chisel a semi-circular forward sweep or two on the stone; then turn the face down, give it two rubs with a semi-circular forward sweep, and your chisel will be sharp. If you should get a wire edge, draw the tool over the edge of a table or board, and it will come off. If this does not remove it, stick the tool upright on the table, and bend it backwards and forwards; then put it on the stone again, giving it, with the hand raised, the semi-circular sweep we have before described. Sharpen your gouges in the same way, only you must keep turning your hand as you rub to and fro, so that each part of the edge of the gouge may come in contact with the stone. We sharpen our gouges in a manner different from most people. We hold the gouge across the stone, giving it a rocking motion by turns of the wrist, as we push it up and down the stone. To explain: Bring the gouge close to you, holding it across your body; put the further corner of the gouge down on the stone, push from you, and at the same time turn your wrist, so that the upper or nearest corner comes down on the stone; drawing it back, reverse the motion, and in this way every part of the edge of the gouge will be equally ground by the stone. We have found this by far the best plan, as the edge does not get rubbed away more in one place than in another. Then, as you can not sharpen the face, which is hollow, on the oil stone, take the slip between the finger and thumb of your right hand, and holding the gouge firmly in the left, sharpen the inside of the tool. Take care not to rub away too much of the face of your tools, for it is the hardest and most precious part.

The V tool is the most difficult of all to sharpen. This must be done with the flat side of the slip, and take care that it is not more rubbed on one side than the other. It will require considerable practice and much patience to learn to sharpen this tool well; but in this, as in all other things, remember the old Spanish proverb: "With patience and perseverance the mulberry leaf becomes a silk gown." The final touches, which give to the tools the last degree of sharpness and smoothness of edge, are given on a piece of stout leather, about an inch and a half wide and eight inches long, glued to a board, and rubbed over with the very finest emery paste, which is emery made into a stiff paste with tallow. The emery must be perfectly free from grit; and, to obtain it in this condition, you must get some of the very finest flour of emery and mix it with water in a tall jar, such as a good-sized fruit jar. After stirring it up vigorously, allow it to settle for say a minute; pour off the liquid into another vessel, and allow the fine powder that remains in it to settle completely. Pour off the liquid, dry the powder, and keep it for use. The strop should be kept carefully covered, to protect it from dust; and, if the emery be good, it will impart to your tools an edge

as keen as that of a razor. The leather should be hard, firm, and of even texture. Some persons recommend soft buff-leather; but this, we think, is a mistake, and we know that it does not sharpen nearly so well as a piece of hard leather that will not yield to the tool; for it is easily seen that if the leather is soft and yields, it will curl up behind as the tool passes on, and will round off the edge instead of leaving it a true bevel.

To be continued.

How to Study Entomology.

BY F. C. SMITH.

V.

Continued from page 129.

IF a chrysalis be examined closely, all the principal parts of the future moth or butterfly may easily be discerned. The wings will be seen folded around and under the thorax; the head, eyes, and antennæ are very prominent, and the legs may be distinguished neatly folded under and between the wings, the whole a beautiful illustration of Nature's universal economy of space. The length of time the insect remains in the pupa state varies with the species from three or four weeks to seven years. Many varieties, however, may be forced by a high temperature. The wing of a moth or butterfly just emerged from the chrysalis is really full size, though in appearance it is very diminutive. The fact of its being folded in so small a compass has led to many a dispute among entomologists. A little patience and careful attention during the hatching season will, however, convince the most incredulous. Usually, in three or four hours after emerging, the insect is in a perfect state to kill.

The order *Lepidoptera* is classed at present into two divisions—the butterfly with clubbed antennæ and four distinctly visible wings when at rest, and the moth with feathered and pointed antennæ and a much larger body in proportion to the wings. The secondary wings of the moth are usually covered by the primaries when in a state of rest. The silk of commerce is obtained from the cocoon of the *Bombyx mori*, the moth of which is small and insignificant in appearance. The *Attacus cecropia* spins a cocoon of strong silk, but it has never yet been unwound to the writer's knowledge. No doubt it will some time be used in the arts, as from it could be made the strongest of paper.

To those who make *Lepidoptera* a special study, the "Synopsis of the Described Lepidoptera of North America," by John G. Morris, will prove invaluable.

The *Coleoptera* have four wings, two only being used in flying. The anterior wings are simply sheaths or shells, under which are folded the secondaries for protection when the insect is at rest. The mouth is provided with mandibles, jaws and lips, and the food is masticated. This insect undergoes the larva, pupa and perfect state, and the larvæ being found in almost every soil, is easy of access to the student. A great number live in the excrement of animals, others attack the roots of trees, vegetables, etc., also bark, wood, leaves and fruits.

With even a fair microscope the *Coleoptera* offers a wide field of investigation, as the insects of this order are easy of dissection, and the parts readily accessible.

To be continued.

Home-made Hanging Baskets—I.

(*Illustrated by A. W. Roberts.*)

THE cool nights of October warned me that the frost-king would soon be here, chilling and killing my floral pets, who had bloomed out their beautiful natures all summer. To leave them now to perish seemed like heartlessness.

Having neither pots nor window boxes, I made a grand collection of all such ancient and infirm butter tubs, wash boilers, tin pans and fruit cans, as are to be found about an old homestead. In these I seasoned my plants down till I could procure more fitting receptacles for them. I found the prices of window boxes and hanging

baskets at the largest dealers greatly above the condition of my pocket-book, and as for flower-pots, there is something about their artificial shape, and bricky red look that always produced in me a great desire to cover them over with some material to hide their offending color and form.

How to do it? that's the question. I made my first experiment on a cracked and partly broken flower pot, first scouring it with sand and water, then applying a thin rough coating of plaster of paris, previously colored with a mixture of ultramarine blue and one of the dark chrome yellows, which gave me a dark green of considerable body. After this coat dried, I applied a second rough coating of plaster mixed with burnt sienna and rose pink, which made a rich warm brown. The pot must be moist when the plaster is laid on or it will not adhere.

Fig. 1.

This second coat, as shown in Fig. 1, requires a little practice in laying it on in the serpentine and angular forms. For this purpose I used an old table knife. Mixing a small quantity of plaster at a time with water to the consistency of thick paste, I began laying on the plaster about the rim of the pot, working around the po till I reached the bottom. I then placed the pot on a sheet of oiled or greased paper; this is to prevent the plaster working under the pot, thereby causing it to stand unsteadily. I again laid on more of the plaster, building out the pattern from the bottom of the pot, till it was nearly as large as the rim in circumference. I now had a pot that looked like very deep bas-relief at the base, gradually becoming more shallow at the rim. After the plaster was thoroughly dry, I gave it two coats of boiled linseed oil to bring out the rich colors, and make the plaster tough and impervious to water. To make a hanging basket of this pot, I inserted a greased stick in the drain hole of the pot. To the bottom of the pot, and around the stick, I built more ornamental work in plaster, extending the pot down to a point. I then withdrew the stick, thus leaving a hole through the plaster for drainage. To hang

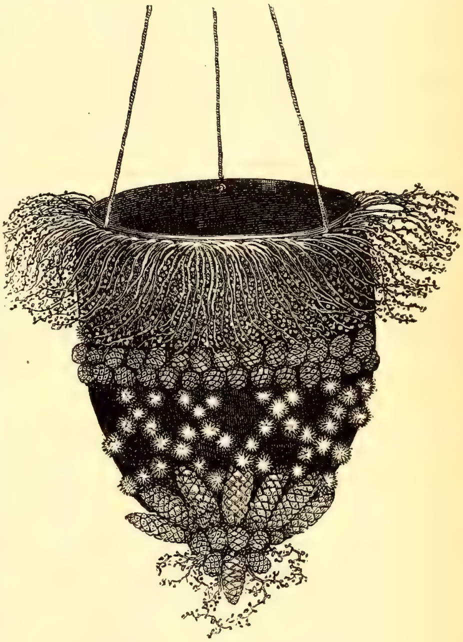


Fig. 2.

this pot, I bored three holes just under the rim; in these holes I fastened nickel plated wire cords (such as are sold by picture frame dealers), bringing the ends together a yard above the pot, and hanging it to an iron hook screwed to the top of the window.

My next attempt was with a cocoanut

shell, as shown in Fig. 2. I sawed off one end of the cocoanut, cleaning out the meat thoroughly; then scraped off the rough fibres with a piece of window glass, and after this I sandpapered it down smooth and varnished it. To the cocoanut I fastened the burrs of the liquid amber tree with a cement of hard asphalt, thickened with lampblack, first grinding the lampblack in asphalt varnish to cause it to mix more readily with the hard asphalt when heated. Around the centre of the nut I fastened a band of pine cones. The bottom I finished off with cones of the fir tree. Along the rim of the nut I bored holes, and into the holes I inserted branches of black alder with the burrs on. I also bored a hole at the bottom for drainage, otherwise the earth in the pot would sour, and the plants die. In this hanging pot I planted young plants of Maurandya, which twined amongst the alder branches. I also planted slips of the so-called German ivy, to twine up the nickel wires.

Microscopy.

What Can be Done with a Cheap Microscope.

SO much has been published of late about the great superiority of the microscopes made by first-class opticians, and the comparative inferiority of the cheaper forms, that there is danger that the owners of the latter may get discouraged, and abandon altogether the use of the microscope, because they cannot afford a Zentmayer Centennial Stand and first-class objectives by Tolles or Spencer. Now, while we yield to none in our appreciation of the work of great microscope makers, and would earnestly advise every one to get as good an instrument as circumstances will allow, we think it may be well to give the owners of cheap instruments a word of advice and encouragement.

By a cheap microscope is meant one costing less than $30. For any sum less than this it is impossible to procure, in the present state of the market, an instrument possessing the qualities and appliances necessary for the performance of anything except the most elementary work, but then, on the other hand, it is astonishing what a wide range of ground is covered by the term "elementary work." If we take the cheapest form, say a common lens of a quarter-inch focus, we will be able to see a great deal that is utterly invisible to the unassisted eye; with a $20 microscope, judiciously selected, we can follow almost all the descriptions and explanations found in the ordinary text books. Let us take a middle ground, and consider the capabilities of such an instrument as may be had for from $10 to $20.

Such a microscope will not enable us to determine disputed points in histology, or to investigate the structure of test objects like the *Podura* scale, or *P. angulatum*. But it will show us clearly and well the various kinds of tissues, and even the cyclosis or so-called circulation of the sap in plants; it will show us the forms of the various kinds of pollen, and the number, situation and form of the stomata or breathing pores of plants; it will even show the more minute forms of plant life—those beautiful desmids and diatoms, which have always been the delight and the admiration of those who use the microscope, and although it will not enable us to see the markings on the more minute diatoms, it will show us their general forms and outlines, and reveal to a diligent and careful observer much of their life-history.

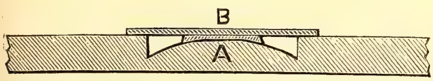
In animal physiology it will show us the peculiar forms of the blood of different animals, and it will show readily that most wonderful and beautiful of all microscopical objects, the circulation of the blood in the foot of the living frog. It will show us the structure of muscular fibre, and the peculiarities of the epithelium which lines the various internal organs. By it we can trace clearly the outlines and structure of many of the lower forms of animal life which

would be otherwise invisible, and we will be thus enabled to assign them their proper place in the great system of classification. By it, too, may be studied the habits and life-history of the majority of the animalcules found in liquids.

That these statements are not exaggerated is shown by the fact that some of the most important discoveries have been made by means of microscopes far inferior to those that can now be had for $20. Indeed, much of the work of the great Ehrenberg was done with a microscope which to-day would not command $25. Therefore, let not the owners of cheap microscopes despair, for the field which is open to them is sufficient to occupy the longest life, and te employ the highest powers.

The Weber Slide.

THERE is no doubt in the minds of those who use the microscope that living objects, whether animal or vegetable, are by far the most interesting, especially to beginners, and a simple and inexpensive means of preserving and exhibiting them has long been a desideratum. The well-known live-box or animalcule cage serves the purpose very well, but it is expensive, and does not entirely prevent the evaporation of the liquid in which the objects are contained. The ordinary concave slide,



THE WEBER SLIDE.

though better than a plain slip of glass, does not fulfil all the requirements, and with such a slide it is difficult to keep the object in focus, except with very low powers.

To obviate these difficulties, Mr. Weber has reversed the form of the cell, and forms his slide as shown in the accompanying engraving, where A is the convex bottom of the cell, and B the thin glass cover—a drop of water being held between them by capillary attraction. When the cover is cemented down by means of a little water-proof cement, the water cannot evaporate, and the whole arrangement forms an air-tight aquarium on a minute scale. The open space forms a chamber which retains a supply of air, and if the animal and vegetable life are properly balanced, life may exist in one of these slides for weeks. Indeed we have been surprised at the length of time that they keep in good condition.

In the engraving, which shows the slide as manufactured by Mr. C. F. Prentice, of this city, the thickness of the slide, etc., is magnified about four times.

Volvox Globator.

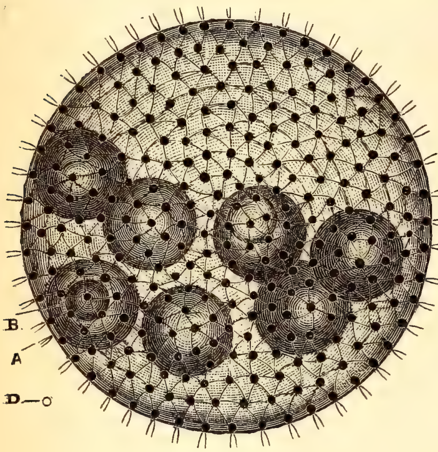
A RECENT English writer tells us that the most popular objects amongst the amateur microscopists of his country are the *Volvox globator* and the *Conochilus*, and there can be no question that they deserve all the attention that has been bestowed upon them. Fortunately they are both found in the ponds of this country, so that we feel certain that our readers who will carefully seek for them will be pretty sure to find them. During the past few years, the life-history of the *Volvox* has been very carefully and thoroughly worked out, and those who desire to study it will find a very excellent article by Prof. Alfred W. Bennett, in a recent number of the *American Journal of Microscopy.* But as this article is very elaborate, we have thought it well to prepare the following simple description for the benefit of our younger readers.

When first discovered by Leeuwenhoek, about two hundred years ago, it was regarded as an animal, and even now the uneducated observer can hardly believe that it is a vegetable. Such it is, however, despite its power of locomotion, and its very peculiar and beautiful form. The reader must bear in mind that there are many minute plants that have the power of moving through the water in which they live—some of them with considerable speed.

The usual appearance of the *Volvox* is very well shown in our engraving. Under a moderate power, it appears as a pale green globe covered with dots, from each of

which proceed two cilia, and it is the motion of these cilia that cause the globes to roll through the water. In the interior of the *Volvox* may be seen from two to twenty smaller globes, and sometimes these small globes contain others still more minute. After a time the small globes escape from the parent globe, and pursue an independent existence, after which the parent dies.

It is not many years since the *Volvox* was considered quite a rarity in this country, and many good microscopists believed that it was not to be found in American waters. The writer has a distinct impression that he



VOLVOX GLOBATOR.

was told by the late Dr. Goadby, who was quite familiar with it in England, and had traveled extensively in this country, that he had never met the *Volvox* in America, and yet Goadby was quite familiar with the microscopic inhabitants of our ponds. At any rate it is but a few years since the writer himself first saw it and published the fact, but since that time it has been frequently discovered in localities in which it was not supposed to have been previously found. It must be remembered, however, that the *Volvox* is very apt to escape the observation of those who are not familiar with it, and yet, like the well-known puzzle pictures, when once seen it is ever afterwards quite obvious when present. Evidence of the truth of this statement is found in the fact that while the ponds around London have always been famous for *Volvox*, Baker, at the time of writing the first edition of his book, "Employment for the Microscope," (1753) had never found them himself, and wrote his description from specimens accidentally found in water sent to him from Yarmouth by a friend.

The *Volvox* is generally found in clear still water, free from such filth as sewage and decaying animal matter. The clear, open spaces amongst water plants are always likely places. We have found it in ponds densely shaded by trees, and also in those that were entirely exposed.

In searching for the *Volvox* and similar organisms, we have found the best instrument to be a clean homœopathic phial of good size—say half an ounce. Such a phial may be fastened to the end of a cane by means of the cheap little device shown on page 131 of "How to Use the Microscope." A "dip" may then be taken from any clear pool, the bottle removed from its holder, wiped dry on the outside, and examined with a half-inch lens. The *Volvox*, if present, will be seen as a pale-green globe, rolling about in the water and having little specks in its inside. In order to cause all the water to pass before the lens, it is well to give the bottle a slight whirl.

Under a power of twenty-five to fifty diameters, such as can be had from any cheap microscope, the *Volvox* presents a most beautiful and interesting appearance. To examine its ultimate structure requires good instruments, but its general form and its beautiful movements may be seen by means of a little French stand costing $2.50.

The Heavens for November.

BY BERLIN H. WRIGHT.

THE computations in the following are made for the meridian of New York city, and are expressed in mean or clock time:

The Superior Planets—How to Find Them, and their Telescopic Appearance and Ephemerides.—Mars is an object of great interest, both to the practical astronomer and the amateur observer. His surface has been more closely studied than that of any other planet, and though 51,000,000 miles distant, the natural divisions of its surface are accurately mapped and named. Thus Herschel Continent, Cassini Land, Hind Peninsula, Phillip's Island, Delure Ocean, Delambert Sea and Arago Strait, are among the natural divisions given in *our* Martial geography.

A telescope of two-inch aperture will give fair views of the continental mark-

ings; and a smaller glass of the snow-capped poles.

At and near quadrature, and for fifty days before and after opposition, Mars presents a gibbous phase, which is easily seen with a telescope having an aperture of two inches.

He is now a morning star, and rises as follows:

1st—5h. 19m., morning.
10th—5h. 13m., morning.
20th—5h. 9m., morning.
30th—5h. 3m., morning.

On the 1st he rises about 6° north of the sunrise point. He is moving eastward among the stars of the constellation *Virgo*, and will be very near the brilliant star, Spica Virginis during the latter part of the month, being 2° 58′ north of it. He will be in conjunction with the moon Nov. 22, being about 6° north.

Jupiter presents the best field for the amateur of all celestial objects, and is one of the easiest to observe. When near opposition, and his maximum northern declination, his brilliancy is not excelled by that of Venus when brightest, which is the only planet which ever exceeds him in brightness.

His four satellites may be seen with a good opera-glass. We have seen it stated that the two outer ones have been seen with the naked eye, but we doubt it. The objects seen must have been small stars in the vicinity of the planet. His moons are always to be seen nearly in a straight line with the planet, extending east and west. Sometimes all four will be on one side, two on each side, or three on one and one on the other. One, two, or even three, may be invisible at once, being eclipsed, occulted, or in the act of making a transit.

An opera-glass will answer to observe an eclipse or occultation with, but it requires a telescope of two-inch aperture to see the shadow of a satellite make a transit across the planet's disc, and a three-inch instrument to see the satellite itself while in transit. The inner two transit and are occulted by the planet at each revolution around Jupiter; the third may occasionally pass very close to his northern or southern limb, while the fourth is frequently seen during an entire revolution.

Jupiter is an evening star, and sets as follows:

1st—10h. 8m., evening.
10th—9h. 38m., evening.
20th—9h. 6m., evening.
30th—8h. 35m., evening.

He is moving eastward very near the eastern limit of the constellation Sagittarius, and will be very near the moon on the 28th, being about the moon's apparent diameter south of her.

The visible phenomena of his satellites for November are:

Satellite I, begins a transit at Jupiter's eastern limb, Nov. 1, 7h. 11m., evening; is followed by its shadow at 8h., 29m., evening, and emerges at 9h. 31m., evening. Begins transits also at 9h. 9m., evening of 9th; and at 7h. 37m., evening of 24th; and completes one at 7h. 57m., evening of 17th. Reappears from an eclipse at the east of the planet (erect vision *always* understood; for an inverting eye-piece reverse the directions) at 8h. 8m., evening of 2d; and at 6h. 27m., evening of 18th. Disappears at the western limb, being occulted, at 6h. 29m., evening of 9th, and at 8h, 27m., evening of 16th.

Satellite II disappears, being occulted, at 8h. 48m., evening of 5th; and at 6h. 25m., evening of 30th. Completes a transit at western limb at 6h. 40m., evening of 7th; begins one at 6h. 35m., evening of 14th, and reappears from an eclipse at 6h. 16m., evening of 16th.

Satellite III. Shadow begins a transit at 6h. 27m. evening of 10th, and reappears from an eclipse at 8h. 5m., evening of 28th.

Satellite IV disappears in an eclipse at 6h. 33m., evening of 7th.

At present all eclipses take place to the *east* of the planet.

For fear of making this article too long, we will simply give the ephemerides of the remaining planets, leaving further remarks until next month.

Saturn is an evening star, and passes the meridian as follows:

1st—9h. 7m., evening.
10th—8h. 31m., evening.
20th—7h. 50m., evening.
30th—7h. 11m., evening.

He is moving westward at the eastern extremity of the constellation Aquarius, being 3° south of the earth's path, and very nearly on the prime meridian of the heavens, from which right ascension is reckoned eastward. He will be near the moon on the 5th, being 7° south.

Uranus rises as follows:

1st—1h. 2m., morning.
20th—11h. 46m., evening.
30th—11h. 7m., evening.

Neptune passes the meridian as follows:

1st—11h. 41m., evening.
15th—10h. 44m., evening.
30th—9h. 44m., evening.

Penn Yan, N. Y.

THE

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Please Renew.

THE next issue of the YOUNG SCIENTIST is the last for this year. With it we complete the volume for 1878, and on looking over the matter which we have given and which will appear in the next issue, we feel that we have kept all the promises which we made to our young friends. Next year, however, we hope to greatly improve the journal. Each number will contain not less than sixteen pages of reading matter, and we have been enabled to add very considerably to our list of contributors.

The December number will contain a title page and a very full index, so that the volume will be in good shape for binding. We have made arrangements to bind them neatly and cheaply. For 35 cents we will bind the volumes in cloth with neat gilt title stamped on the back. The postage on the volume will be ten cents, which must be added when sent by mail.

As this is our busy season, we would ask our subscribers to renew promptly. As it does not pay to incur expense in collecting such small sums we shall conclude that those who do not remit do not want the journal, and their names will be struck from our list.

Laboratory & Workshop

Sympathetic or Secret Ink.

Aside from any practical purposes to which they may be put, sympathetic inks form some very interesting and curious experiments. Thus, if we write on paper with a cheap solution of acetate of lead (sugar of lead), and then either dip the paper in a solution of sulphuret of ammonia, or sponge it with that liquid, the letters will appear of a dark brown. To those who see this for the first time, the effect is very curious. Unfortunately, however, all salts of lead become black when exposed for some time to the air, and therefore they cannot be used for secret correspondence. Salts of iron, prussiate of potash, and several other salts which would make excellent secret inks, are also colored by exposure to the air, and cannot be used. Indeed none of the sym-

pathetic inks ordinarily used can be relied upon as a safe means for carrying on a secret correspondence, from the fact that none of them will bear exposure to a degree of heat just sufficient to scorch the paper.

The term sympathetic ink is applied to any liquid which is used to write letters which remain invisible until the writing has been exposed to heat, to some peculiar vapor, or to some suitable solution. Of those which are brought out by the use of a chemical liquid, the best is a weak solution of starch. This is invisible under ordinary circumstances, but becomes quite distinct when washed with a solution of iodine. Writing that is invisible until exposed to heat may be made with milk, lemon juice, onion juice, etc.

In using a sympathetic or secret ink, it is always necessary to write some unimportant matter on the paper or postal card, and between the lines write with the secret ink. If this method of correspondence were used for anything but an interesting experiment, however, it would not be difficult to find a means by which, after writing with the secret ink, unimportant matter might be written with common ink directly over the first writing, and then, by means of a suitable fluid, the last writing might be washed away, and the first writing brought out.

Imitation Ground Glass that Steam will not Destroy.

Put a piece of putty in muslin, twist the fabric tight, and tie it into the shape of a pad; well clean the glass first, and then putty it all over. The putty will exude sufficiently through the muslin to render the stain opaque. Let it dry hard, and then varnish. If a pattern is required, cut it out in paper as a stencil; place it so as not to slip, and proceed as above, removing the stencil when finished. If there should be any objection to the existence of the clear spaces, cover with slightly opaque varnish. In this way very neat and cheap signs may be painted on glass doors.

Glass Working.

Glass is usually brought into shape by being moulded or blown. There are a few other operations, however, which are constantly needed by the amateur, and which we will describe.

For cutting flat glass, such as window panes, and for cutting rounds or ovals out of flat glass, the diamond is the best tool; and, if the operator has no diamond it will always pay to carry the job to a glazier rather than waste time and make a poor job by other and inferior means. When, however, it is required to cut off a very little from a circle or oval, the diamond is not available, except in very skilful hands. In this case a pair of pliers softened by heating, or very dull scissors, is the best tool, and the cutting is best performed under water. A little practice will enable the operator to shape a small round or oval with great rapidity, ease and precision. When bottles or flasks are to be cut, the diamond is still the best tool in skilful hands; but ordinary operators will succeed best with pastilles, or a red hot poker with a pointed end. We prefer the latter, as being the most easily obtained and the most efficient; and we have never found any difficulty in cutting off broken flasks so as to make dishes, or to carry a cut spirally round a long bottle so to cut it into the form of a cork-screw. And, by the way, when so cut, glass exhibits considerable elasticity, and the spiral may be elongated like a ringlet. The process is very simple. The line of the cut should be marked by chalk, or by pasting a thin strip of paper alongside of it; then make a file mark to commence the cut; apply the hot iron and a crack will start; and this crack will follow the iron wherever we choose to lead it. In this way jars are easily made out of old bottles, and broken vessels of different kinds may be cut up into new forms. Flat glass may also be cut into the most intricate and elegant forms. The red hot iron is far superior to strings wet with turpentine, friction, etc.

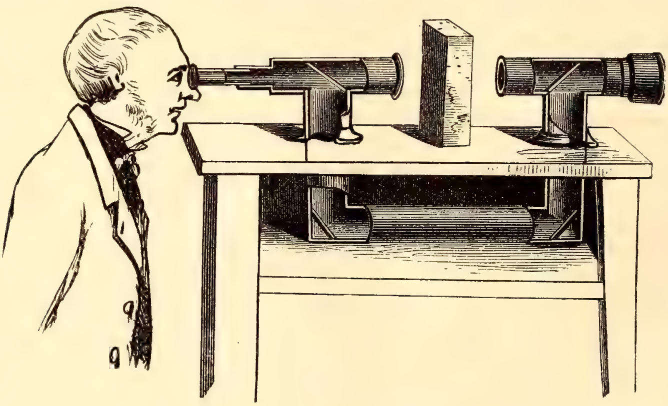
For drilling holes in glass, a common steel drill, well made and well tempered, is the best tool. The steel should be forged at a low temperature, so as to be sure not to burn it, and then tempered as hard as possible in a bath of salt water that has been well boiled. Such a drill will go through glass very rapidly if kept well moistened with turpentine in which some camphor has been dissolved. Dilute sulphuric acid is equally good, if not better. It is stated, that at Berlin, glass castings for pump barrels, etc., are drilled, planed and bored, like iron ones, and in the same lathes and machines, by the aid of sulphuric acid. A little practice with these different plans will enable the operator to cut and work glass as easily as brass or iron.

Black diamonds are now so easily procured,

that they are the best tools for turning, planing or boring glass where much work is to be done. With a good diamond a skilful worker can turn a lens out of a piece of flat glass in a few seconds, so that it will be very near the right shape.—*Amateur's Handbook.*

Looking Through a Brick.

A very common exhibition by street showmen, and one which never fails to excite surprise, is the apparatus by which a person is apparently enabled to look through a brick. Mounted on a simple-looking stand are a couple of tubes which look like a telescope cut in two in the middle. Looking through this telescope, we are not surprised, of course, when we see clearly the people, buildings, trees, etc., beyond it, but this natural expectation is turned into the most startled surprise when it is found that the view of these objects is not cut off by placing a common brick between the two parts of the telescope and directly in the apparent line of vision.



LOOKING THROUGH A BRICK.

In truth, however, the observer looks *round* the brick instead of *through* it, and this he is enabled to do by means of four mirrors ingeniously arranged, as shown in the engraving. As the mirrors and the lower connecting tube are concealed, and the upright tubes supporting the pretended telescope, though hollow, appear to be solid, it is not very easy for those who are not in the secret to discover the trick. Any ingenious boy can easily make this apparatus. The tubes may be made of pasteboard, and the mirrors of pieces of common looking-glass. The telescope should be mounted on a common box, the better to disguise the arrangement. The lid of the box supports the upright tubes, and may form the upper side of the concealed tube. Indeed there is no reason why an apparatus of this kind that would work well, might not be made out of a few old envelope boxes, some bits of looking glass, and a little paper and paste, and if once made it will be a source of constant amusement.

Imitation Terra Cotta.

The following recipe from the *Magazin Pittoresque* will enable our readers to convert plaster casts into excellent imitations of terra cotta ware: The colors required are brick red, lampblack, zinc white, and yellow ochre, all in powder. The object to be treated is first carefully rubbed with "00" sandpaper, so as to remove all roughness of the surface or ridges indicating where the parts of the mold have been joined. The mixed color consists of yellow ochre two parts, brick red two parts, and black one part. These are well rubbed together. Then three parts of zinc white are separately mixed with a little milk to paste. All the ingredients are then combined in a mortar with eight or ten parts of milk, and the resulting mixture is passed through a fine sieve to remove any particles of the white. A soft brush is then used to spread the stain over the object, care being taken to lay it on evenly. After 24 hours' drying, a second coat is applied. When the article is completely dry, rubbing with the fingers will eliminate the brush marks.

Soldering Broken Files.

A writer in the *English Mechanic*, who had broken the only half-round file he had by him, says: "After trying to use the broken end (it was broken about the middle), I was about to give up in despair, when I thought I would try soldering; and, to my surprise, it not only stood while I completed the small job I was then doing, but is in use still, and will stand all the force such a file needs to have applied to it in ordinary use. I used ordinary solder, Baker's soldering fluid, and a Bunsen burner. The temper is injured only at the very joint. Of course I was careful not to heat it more than requisite to melt the solder."

[Baker's soldering fluid is, we presume, a solution of zinc in hydrochloric acid.—Ed.]

To Crystallize Paper and Glass.

The following process is recommended by Professor Bottger: Mix a very concentrated cold solution of salt with dextrine, and by means of a broad, soft brush, lay the thinnest possible coating of the fluid on the surface to be covered. After drying, the surface has a beautiful, bright mother-of-pearl appearance. To make the coating adhere to glass, it is only necessary to varnish it with an alcoholic solution of shellac. The following salts give the finest crystallizations: Sulphate of magnesia, acetate of soda and sulphate of tin. Colored glass thus prepared gives a good effect by transmitted light.

BOOK NOTICES.

Physical Technics; or Practical Instructions for Making Experiments in Physics, and the Construction of Physical Apparatus with the most Limited Means. By Dr. J. Frick. Translated by John D. Easter, Ph. D. Seven hundred and ninety-seven illustrations. Price $3.00. Philadelphia: J. B. Lippincott & Co.

This book is to the experimenter in Natural Philosophy what Faraday's "Chemical Manipulation" was to the chemist. It contains not only minute directions for performing experiments successfully, but very clear instructions for making apparatus and using the ordinary tools. In many respects it is the best work on mechanical manipulation now before the public, and so far as amateurs are concerned, this is certainly true. All the various arts, such as glass-blowing, screw-cutting, soldering, brazing, working with files, planes, etc., are very fully treated. Our readers, old and young, will find it a mine of useful information.

The Amateur's Handbook of Practical Information for the Workshop and the Laboratory: Containing clear and full Directions for Bronzing, Lacquering, Polishing Metal. Staining and Polishing Wood, Soldering, Brazing, Working Steel, Tempering Tools, Case-Hardening, Cutting and Working Glass, Varnishing, Silvering, Gilding, Preparing Skins, Waterproofing, Making Alloys, Fusible Metals, Cements, Glues, etc., etc. Price 10 cents. New York: Industrial Publication Company. 1878.

This is not a mere book of recipes clipped from old journals and encyclopœdias, but a carefully compiled book of instructions for performing those little technical operations which are so frequently required in every-day life, and in the workshop of the amateur. In most of these operations the recipe is but half the battle; when we come to put it in operation we are apt to fail from ignorance of some general principle, or from inattention to some important though apparently trifling detail. In the book before us this defect is avoided, and minute practical directions are given, so that any one may be able to put the recipes in practice. This is specially apparent under such headings as glass-cutting, lacquering, steel working, brazing and soldering, silvering, staining woods, waterproofing, etc.

Current Notes.

To Fix Pencil Marks so they will Not Rub Out.—Take well skimmed milk and dilute with an equal bulk of water. Wash the pencil marks (whether writing or drawing) with this liquid, using a soft camel-hair flat brush, and avoiding all rubbing. Place upon a flat board to dry.

Carrying Water in a Sieve.—The following simple experiment will perhaps interest some of our readers: Take a tumbler and tie over its mouth a piece of bobbinet or other open fabric; immerse it in water, and when partly or entirely full, invert it, and lift it carefully out of the water bottom upwards. The water will not run out, but will remain suspended in the tumbler.

Packing Glass Ware.—Every one has this duty to perform occasionally, and it is well to know how it should be done. The safety of glass articles packed together in a box does not depend so much upon the quantity of packing material used, as upon the fact that no two pieces of glass come into actual contact. In packing plates, a single straw placed between two of them will prevent them from breaking each other. In packing bottles in a case, such as the collecting case of the microscopist, and the test case of the chemist, rubber rings slipped over each, will be found the best and handiest packing material. They have this great advantage that they do not give rise to dust.

To Keep Pipes from Freezing.—The only certain preventive is the removal of the water, and it is worth while to make provision for turning off the water during very severe nights, letting it on during the day time. We must not forget, however, that merely shutting off the water will not answer; the water must be let out of the pipes. To do this a small tap or petcock should be placed just above the main stopcock, or the latter should be made with a vent which allows the water above it to flow out when it is turned off.

Lemon Tree Wood.—A writer in the "Gardener's Monthly" says that when in Rome, a few years ago, he was shown some work made out of the lemon tree that was considered almost as good as if made from box; and he makes the suggestion that a plantation of lemon trees for the wood, to say nothing of the fruit, would be profitable. The lemon tree is generally grown for fruit, but it would no doubt do well from a wood-growing point of view in less favorable climates. The lemon tree ought to do well at the South, and in many parts of California, and as boxwood is becoming quite scarce and expensive, the experiment is worth trying.

Fair of the American Institute.—The large building in which this Fair is held, seems to be better filled than ever this year, and many of the articles on exhibition are of unusual interest. One of the great attractions is the electric light, with which the building is illuminated, thus giving those who desire to see this new mode of lighting an opportunity to do so. One of the most interesting features of the Fair is the machinery in motion, and the various industries, the operations of which are carried on in the building. This makes the Fair one of the most efficient educational agencies in the city, and there is no place to which parents can take their children more profitably than to the American Institute Fair.

Artificial Black Walnut.—A Belgian journal says a new process has been applied to the manufacture of artificial black walnut, by which ordinary wood has imparted to it the appearance of the most beautiful specimens of walnut, adapted to the very finest cabinet work. The wood, first thoroughly dried and warmed, is coated once or twice with a liquid composed of one part by weight of extract of walnut peel, dissolved in six parts of soft water, by heating it to boiling, and stirring. The wood thus treated is, when half dry, brushed with a solution of one part by weight of bichromate of potash in five parts of boiling water, and, after drying thoroughly, is rubbed and polished. The color is thus said to be fixed in the wood to a depth of one or two lines, and, in the case of red beech or alder, for instance, the walnut appearance is most perfect.

A Good Hint for Photographers.—Dr. Thos. Buzzard, who was recently undergoing the usual ordeal in a photographer's gallery, conceived the idea of suggesting some arrangement for relieving the eyes during the time it was necessary to keep them fixed upon a given object. In his own case he found that staring at a certain spot caused his vision to become indistinct, and surrounding objects became lost, as in a thickening mist, whilst as the sitting was prolonged, a feeling of giddiness and even faintness was experienced. The plan he suggested was to draw upon a piece of card, about four inches in diameter, a clock-face, and add the usual Roman figures. This card was fixed about eight feet distant, and when the sitting began he fixed his eyes upon the figure XII, and then upon the I, II, III, and so on all around the clock, shifting his gaze leisurely from one figure to the other. The result was the sitting ended without any sense of strain, and he seemed to have sat without an effort, while the slight change in the direction of vision required did not at all affect the accuracy of the portrait.

Studio Glue.—Every one knows what a nuisance it is to "heat the glue-pot" when some small mend has to be made. And most people also know that all substitutes for glue are more or less failures for wood work of all kinds; and, indeed, for most kinds of soft substances there is no cement that is so thoroughly satisfactory as glue. I have found an exceedingly simple way of using glue for small mends, and for general purposes where but a little is wanted at a time. The simplicity of the matter is so great as almost to need an apology for mentioning it, but its utility is so great that I must make that my excuse for writing about it. This is the method: Put a pinch of Nelson's shredded gelatine into a wide-mouthed bottle; put on it a very little water, and about one-fourth part of glacial acetic acid; put in a well-fitting cork. If the right quantity of water and acid be put, the gelatine will swell up into worm-like pieces, quite elastic, but at the same time, firm enough to be handled comfortably. The acid will make the preparation keep indefinitely. When required for use, take a small fragment of the swelled gelatine, and warm the end of it in the flame of a match or candle; it will immediately "run" into a fine clear glue, which can be applied at once direct to the article to be mended. The thing is done in half a minute, and is, moreover, done well, for the gelatine so treated makes the very best and finest glue that can be had. I have no doubt this plan might be modified by dissolving a trace of chrome alum in the water used for moistening the gelatine, in which case, no doubt, the glue would become insoluble when set. I have not tried this, as, for general purposes, there is no need for subsequent insolubility in glue.—*Photographic News.*

The Young Scientist

SCIENCE IS KNOWLEDGE. KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL FOR AMATEURS.

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Masked Christmas Gifts.

OUR small folks having lost all faith in the kindly offices of the little old gentleman who once a year is supposed to fill long stockings and short socks, I determined to have all Christmas presents masked in various articles of food, and in this way bring about a series of surprises and enjoyable mysteries. Strict orders were therefore given to the cook to provide an abundant supply of cold slaw with the oysters, and that pumpkin pie must not be forgotten as part of the Christmas dinner.

After all the big and little folks had retired, I descended into the kitchen to make my first experiment.

Of course Bridget was to be up first in the morning; why not begin with her presents first? So selecting the pumpkin which was purchased for the pies, as a most promising subject for a beginner, a square was cut out from about the stem with a thin and sharp-bladed knife, taking care to bevel the edges inwardly to prevent the piece from falling into the pumpkin when put back again (see Fig. 1). Great care was taken to avoid making false cuts or tearing the skin of the pumpkin. The seeds and pulpy fibre were then removed from the inside, which was rubbed dry with a coarse towel.

Bridget was to have two presents—a string of black beads and cross, supposed to look like real jet, and a silk handkerchief. The beads were done up in several thicknesses of paper, securely tied with string, and labeled "Miss Bridget Lundragun's Christmas," so that there might be no mistake about the ownership. The piece that had been cut out was then put back in its place and securely fastened with entomological pins, as shown in Fig. 1. As the seam and the pin heads showed in places, I rubbed dry flour on the pumpkin, which gave it a "must have fallen into the flour barrel" look. It was then left on the table for Bridget's early attention.

The cabbage was doctored the same way, a piece being cut out where the stalks grew and the inside scooped out with an old

table spoon, the rim of which had previously been ground to a sharp edge. In this was placed the handkerchief, done up in many wrappings of old muslin to prevent the moisture contained in the cabbage from affecting the finish of the fabric, and to

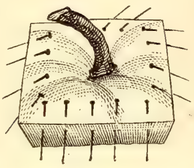


Fig. 1.

protect it from the cutting knife. Brown bread and rolls, and a loaf of either wheat or rye bread had been ordered for breakfast. Ascertaining that all these things were in the house, I visited the baker and duplicated all the above named articles (as those containing the presents would not be fit to be eaten) securely hiding them so that they might be produced when needed. Taking the loaf of brown bread, I made a clean cut half an inch below the top (Fig. 2, dotted line), then scooped out the inside, taking care not to make the walls of the hollow loaf too thin. In this I placed a piece of jewelry bountifully wrapped in cloths to make it fit compactly inside the loaf, and

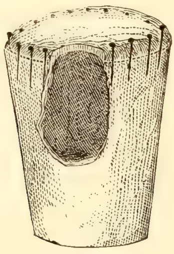


Fig. 2.

prevent anything loose being felt inside. The cloth also protected the jewelry from the knife when the bread was cut. The top of the loaf was fastened in its place with long pins (Fig. 2), and the joint was covered with a brown paste made of crumbs of the bread. The loaf was then placed in the oven for half an hour to thoroughly bake the paste joint.

The rolls were mostly filled with candies, each roll containing a different kind; others held a gold pencil case, a pair of child's kid gloves, etc. The hollowing out of the rolls and sealing up was found to be very easy, being accomplished in this way. From the bottom of each roll I cut out a square piece of crust; with my fingers I removed all the inside crumb, then filling the rolls with candies, fastened the square crust lids in their places with thick paste made of plain flour and water. The paste showed in places, and fearing it might not be dry by morning, I slightly moistened the entire bottom of the roll, then dredged it with dry flour, and applied a hot flatiron, which dried the paste thoroughly, and browned the bottom of the rolls very handsomely. The loaf was treated the same as the rolls and filled with nuts.

For dessert we had a very large English plum pudding, in which a very great number of presents were contained—a finger ring, a velocipede, a boy's sled, skates, a knock-me-over-knick-knackery what-not stand, two monkeys that were painfully pushed head first over sticks, a child's cooking stove, a skipping rope, and a train of steam cars. It was easy to win Bridget over as an accomplice in this fearful undertaking, and together we did it.

The ring was covered very closely with tin-foil to prevent the dough working about the jewels. I then pushed a close fitting cork through the ring. This cork was for the purpose of buoying up the ring, otherwise it would sink to the bottom of the pudding. Over the cork and ring I rolled a thin coating of stiff dough coated with dry flour, which caused it to hold fast to the soft batter of the pudding just where it was desired that the ring should remain.

"Now for the velocipede, Bridget!"

Bridget shook her head and exclaimed: "Indade, Sur, but you can never do it!"

"Bridget," I exclaimed with terrible resolution, "Where there's a will there's a way. I'll just go round to the 'nice old

lady's' toy store, purchase the presents, then into the pudding they've got to go."

Returning in a short time, I demanded of Bridget full charge of the pudding until I got all the presents into it. I then sent her on an errand some six blocks away, so that she might not witness this wonderful performance. When she returned the pudding was in the pot boiling away like mad.

"Now, Bridget," I said, "not a word till the pudding is on the table, and then out will come the presents."

When dinner was over, Bridget brought on the pudding, holding it at arm's length, as though it held some evil spirit concealed within. The children looked slightly disappointed, and had evidently given up all hopes of any presents turning up at this meal. By this I inferred that they had not the least suspicion of what the pudding contained. Ned, being the eldest, was helped first. Scarcely had he attacked it, however, when he suddenly dropped his spoon and shot into the kitchen; in an instant I saw him dash past the windows and down the street. I next served Mary, who also quickly left the table, and seemed to take the same course as Ned. Presently back they both came; Ned with a velocipede and a pair of skates, his sister bowed down under a knock-me-down-knick-knackery stand.

All the children got their presents out of the Christmas pudding, and this is the way it was done: Cutting up a sheet of writing paper into four pieces, on each piece I wrote an order reading thus: "Mrs. Gray, please deliver to bearer articles marked No. 1." Each of the children was represented in the pudding by one of these orders. Before I placed the orders in the pudding, I folded each one into a small compass, and securely covered it with tin-foil, after which it was fastened to a piece of flat cork to keep it in its position on the top of the pudding. The corks were of different sizes, the largest one for the oldest child, and so on to the smallest cork, which represented the youngest. In this way I was sure of giving the right order to the right child. As I dealt out each piece of pudding, it was turned upside down, bringing the order underneath; over it all I poured the sauce, which gave the plate of pudding a very innocent look. The guessing as to what kind of a present the numbers on the orders represented, the journeys after the presents and having to help each other home with them, and the lots of thanks I got, will cause this wonderful Christmas table never to be forgotten.

In using these different disguises for the presents, I tried to retain the relative weight of each article used, so as not to excite suspicion by unusual lightness. Each article was firmly packed with cut paper to stop all loose feeling or looseness. Every article was plainly labeled with the name of the person for whom it was intended.

A. W. Roberts.

Lessons in Magic—II.

Skill in the art of palming, as explained in our last number, can only be acquired by persistent practice. The learner should therefore practice until he is master of every movement. In my next I shall explain, among others, the always popular "Obedient Cards," in which the cards rise at command from the pack, and in the meantime give one more trick depending upon the instructions given in the first lesson.

Passing a Marked Coin into a Lemon.—The performer borrows from one of the audience a coin, which he allows to be marked in such a way that it may be readily identified; and then gives it to a person to hold. He next produces two lemons, and allows the audience to choose one with which he shall do the trick. The chosen one he impales on the point of a knife, and approaching the person who holds the coin, requests him to take the knife by the handle, and hold it up high, so that the lemon may be in sight by the whole company. Taking the coin, which the gentleman has till that moment held, he closes his hand upon it, bids it "pass," and opening his hand, shows

that it is empty. He requests the person who holds the lemon to cut it open, and examine the coin which he will find inside, and say whether it is the one that was marked, which it invariably proves to be.

This trick is always attributed to "confederacy," the audience supposing that the person who cuts open the lemon and takes out the coin, is in collusion with the performer. Such, however, is not the case, as it is purely sleight-of-hand.

In order to perform it, two lemons are prepared by cutting slits in them large enough to admit the point of an ordinary table-knife. The next thing to be done is to determine what coin is to be used. I will suppose it to be a nickel five-cent piece. The performer takes one of these coins, and holds it concealed in his left hand, either by palming or otherwise. He is now ready to begin his trick, which he does by requesting one of the audience to lend him a five-cent piece. "Not a silver one," he explains, "but the ordinary nickel piece." Having got one, he asks several persons to mark it, that there may be no mistake about it when the trick is over, and then gives it to some one to hold. He tells him to hold it up, so that every one may be able to see it; "Not that way, my dear Sir; hold it so." As he says this, he takes it from him, under pretence of showing how it should be held, and instead of returning it, gives him the one he has held concealed in his hand. No one suspects for a moment that he has given him any other than the marked coin. He now produces the lemons, which he holds in such a way that the slit will not be seen, and when one has been chosen, he throws the other aside, and whilst going to his table under pretence of getting a knife, he slips the coin into the slit. He runs the point of the knife into the slit, and then hands both knife and lemon to the person who has the coin, and tells him to hold it up. Next he asks for the coin. He takes it with his right hand, lets it slip up his sleeve, and pretends to put it into the left hand. He manœuvres with the right hand, so that all may see it is empty, and then bids the coin to "pass" into the lemon. He opens the left hand shows that it contains nothing, and then bids the person who holds the lemon to cut it in two, and in the centre he will find the coin. Whilst the audience are watching this, the performer drops his right arm, and lets the coin which is in the sleeve fall into his hand, from which as soon as possible, he transfers it to his pocket.

The trick is now done, but, as the province of a conjurer is to amuse as well as astonish, he indulges in the following innocent joke:

The coin having been identified, he proposes to do something still more wonderful, no less a feat than that of passing half the lemon into the coin.

"No doubt, ladies and gentlemen," he says, "you think this an impossibility; but you must remember that I do not really do all that I seem to. I merely deceive your senses, and make you think I perform miracles."

"Now, Sir, hold the coin well up." He pretends to take half the lemon in his hands, but lets it drop into a pocket fastened at the back of his table, and with his hands together, as if holding the lemon, he approaches the audience.

"Now, sir, when I count 'three,' hold on tight to the coin, else the shock of the lemon passing into it may carry it out of your hand. Now, then, 'One,' 'Two,' 'Three!' 'Pass!'"

He opens his hands, to show that they are empty, and then bids the gentleman who holds the coin to *cut it open, and he will find the half-lemon inside of it.*

There is one very important part of this trick that I find I have neglected to explain, and as it is needed in many other tricks, I will tell my readers how.

To Change a Coin received from the Audience to a Prepared Coin.—Have the prepared coin concealed by being palmed in the left hand. Take the one loaned by the audience in the right hand, and, palming it, pretend to pass it to the left; show the

coin which is in the left hand, and it will be taken for the one that was borrowed.

This is a most useful feint, and by it the coin in the "lemon trick" is changed, when it is taken from the person who has it, under pretence of showing how it should be held.

Memory.

THE power of the human mind to remember any series of statements or facts, is greatly increased if we are enabled to see a distinct connection between them. The great difficulty of remembering a disconnected series of sentences was once well illustrated by Foote. Macklin was lecturing upon literature and the stage, and in discussing the education of memory, boasted that he could repeat any formula of words after once hearing it. Foote was in the audience, and at once wrote and sent to the stand that rigmarole that has since grown so famous: "So she went into the garden to cut a cabbage leaf to make an apple-pie; at the same time a great she-bear, coming up the street, pops its head into the shop. 'What! no soap!' So he died, and she very imprudently married the barber; there were present the Pincininies, the Jobolilies, and the Gayrulies, and the grand Panjandrum himself, with the little round button at the top; and they all fell to playing the game of catch-as-catch-can till the gunpowder ran out of their boots."

Macklin failed, and, short as it is, it is not very often that a person is found who can repeat it after hearing it only once or twice.

Pond and Stream.

OF all objects for microscopic study, there is nothing in my estimation to compare with the living objects of pond and stream. They will furnish more beautiful and interesting objects than the most complete cabinet. To this department the microscope should be more particularly devoted.

There is no question that from this kind of inquiry more important results may be obtained than from any other. Here it is not necessary to diverge from the main object (observation) to dissect, cut, slice, grind or polish, before you can examine, all of which requires abundance of leisure time, and cannot be very interesting as it is only a means of getting an object for examination, unless making a special study of an object.

Pond and stream life furnishes work for both high and low angled lenses, penetration or no penetration. It is a magnificent sight to get a rhizopod (*Difflugia proteiformis*), or a diatom (*Gomphonema elongatum*) drift across your field under a 180° lens; they sparkle like a Koh-i-noor, and then under a comfortable working lens, like the inch of 25° or 30°, take a survey of your pasture.

How interesting, under a low power, to get a diminutive view of some rare object or peculiar action, and then bring the matter up clear and enlarged with a higher power. How vastly easy is microscopical analysis in comparison with chemical! With the microscope the imperceptible is made perceptible at once; the chemical requires great labor and time. H. WATSON

Providence, R. I.

A Hint for Skaters.

Mr. Jos. G. Kitchell, of Cincinnati, O., sends the following, which may prove beneficial to those who, for the sport of skating, often undergo great personal risk: "Cut or select from the carpenter's lumber, a strip or rod of ash, walnut, maple, or any light yet strong wood, procure a round piece three-fourths of an inch in diameter, and about six and a half feet long. Take this with you when going to skate; grasp it near the centre with the right hand, and carry vertically; if the ice should break, and you sink, a little presence of mind and the rod, which you throw horizontally as the first cracking is heard, will prove very valuable, as you can keep head and shoulders above water until help arrives, or enable you to emerge entirely by shifting the rod, so that it rests on the thickish ice around the hole. You will find from a little use that it is not in the least an incumbrance, but it gives a graceful appearance to the skater, will often avoid a fall, and will insure a greater aid to beginners on skates, I think, than the helping hand of an interested expert."

Home-made Hanging Baskets—II.

(*Illustrated by A. W. Roberts.*)

THE variety of designs which may be worked out of even the commonest forms of ordinary earthen flower pots, and the great extent of common and otherwise worthless materials from which supplies may be drawn, encourages me to add a few more designs to those already given. It is a well known truth that it is labor guided by taste and skill that confers value upon most articles. Even the rude iron ore, which is trampled under foot and regarded as dirt, becomes, when worked into some products, worth more than its weight of the finest gold.

Fig. 1 is a nine-inch flower pot, bored full of holes of the size shown in diagram, Fig. 2. After the holes were bored, I gave the pot a coat of dark green paint, which was then dusted over with fine brown sand (washed clean and dried) mixed with white frosting or pounded white glass, to give the pot a glisten like granite and subdue the too painty look it might otherwise have. In the bottom of the pot, over the drain hole, was placed a large piece of sponge. This sponge was for the purpose of retaining a liberal supply of water for the very large number of plants used in this hanging pot, and was necessary from the fact that they are of a kind that delight in moisture. Over and around the sponge the pot was

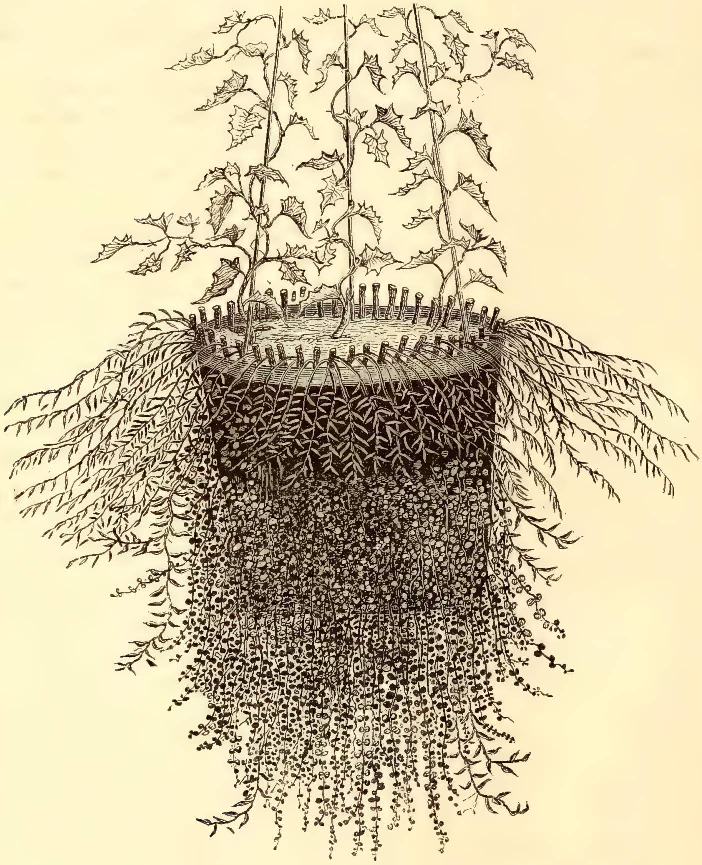


Fig. 1.

filled in with a layer of rich soil, reaching the first circle of holes. In these were inserted slips of zebra grass (*Tradescantia zebrina* and *T. aquatica*) also moneywort (*Lysemachia numularia*), covering them with earth well pressed about the slips. In this way the pot was filled to the rim.

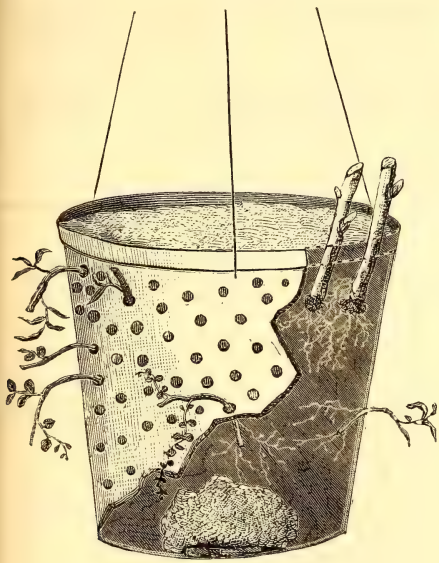


Fig. 2.

I next planted slips of willow (pointed at the ends, so as to enter the soil readily) around the inside of the rim of the pot, each slip having four buds, two for rooting and two for starting young sprays. If both buds started, the one facing the inside of the pot was pinched off. These slips of willow, in course of time, produced a long drooping spray over the top of the pot, giving a graceful effect. Inside the pot I planted German ivy, which was trained up the wires of the pot. Some of the slips of moneywort grew down from the pot a yard in length; these I looped up and tied to the willows.

Fig. 3 is an old fruit can, which was soaked in water to remove the label and paste, after which it was dried thoroughly and two coats of asphalt varnish applied. Around the can I worked designs with stove cinders or clinkers from a boiler furnace, selecting those of picturesque form, bright color and light weight. These were first washed and dried in an oven, and then fastened on the can with hard asphalt cement. I touched up the cinders with

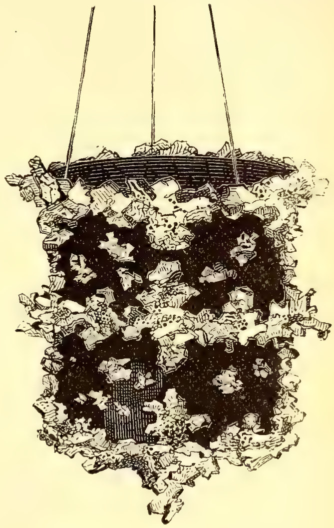


Fig. 3.

very brilliant colors in distemper. By distemper is meant dry colors ground in the smallest quantity of gum arabic as a fixative. I also used gold and silver bronzes for touching up the high reliefs. In some places the field of black varnish being large, produced a sombre effect; this was broken up with splashings of small pieces of cinders highly colored. Over all I applied a thin coat of furniture varnish. Through the bottom of the tin, from the inside, a hole was punched for drainage.

For richness of artificial effect in colors, texture, form and lightness of material, this combination of cast aside rubbish far exceeds any attempt I have made to utilize such articles.

Omitted.—The title page and index have made such inroads on our space this month, that we have been obliged to omit many things that otherwise would have appeared. Exchanges and correspondence have been held over, but will appear in the January number, which will be sent to all now on our books.

The Heavens for December.

BY BERLIN H. WRIGHT.

MERCURY will be brightest, as an evening star, Dec. 5-8, setting Dec. 6 at 5h. 44m., eve.—1h. 12m. after the sun, and 27m. before the end of twilight, at a point about 3° south of the Sun's path;* at star LAMDÆ SAGITTARII. On account of his extreme southern declination, this will not be a favorable opportunity to see Mercury, and doubtless many who are not accustomed to search the Heavens will fail to find him.

VENUS, being in superior conjunction with the Sun, Dec. 5, cannot be seen this month.

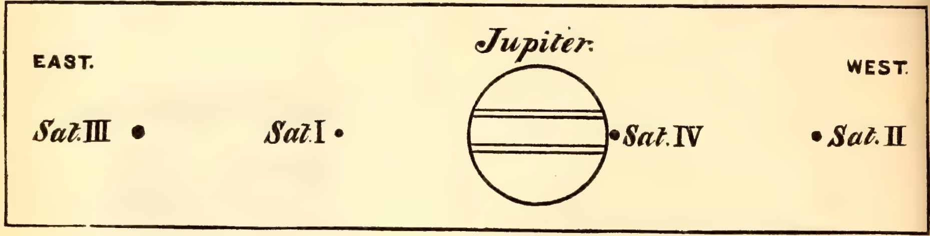


Fig. 1.

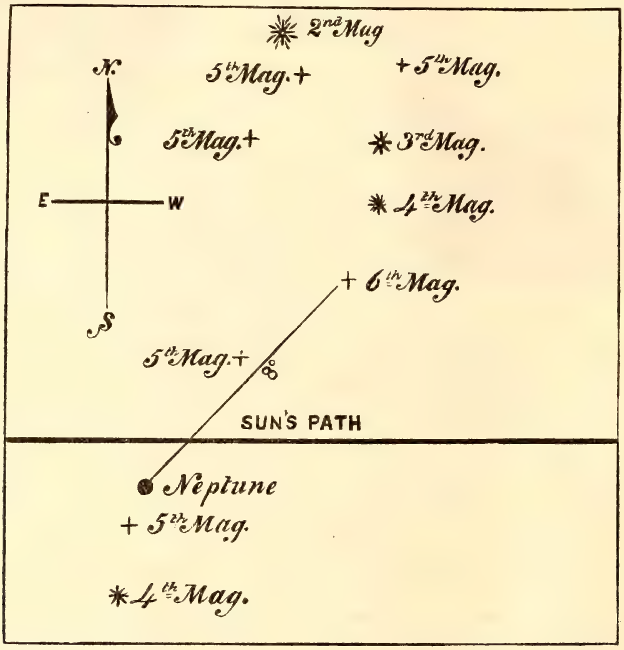


Fig. 2.

which time he will be very near the 4th magnitude

*For the convenience of the reader we give in this place several units of measurement. The "Ell and Yard," called also the Three Stars, Three Kings, and, in Job, the "Bands of Orion," rise about 7 o'clock in the evening. It is composed of three 2d magnitude stars in a straight line, just 3 degrees long, the middle star being 1½ degree from each extreme. This makes a good yard stick. The "Pointers" are the two stars which form the side of the Great Dipper, opposite the handle, and are 5 degrees apart. The two in the top are 10 degrees apart. The North Star is 28¾ degrees exactly north of the Northern star of the Pointers.

MARS will be within the quadrilateral of Libræ (composed of two stars of the 2d, and two of the 3d magnitude) until the 10th, and will enter the constellation Scorpio Dec. 22, following very closely the Sun's path. He rises as follows:

Dec. 5—5h. 1m., morning.
Dec. 15—4h. 57m., "
Dec. 25—4h. 53m., "

He will be 5° north of the Moon Dec. 21.

JUPITER will be a conspicuous object in the western sky throughout the month, setting as follows:

Dec. 5—8h. 20m., evening.
Dec. 15—7h. 51m., "
Dec. 25—7h. 22m., "

He will be about 1° south of the Moon Dec. 26, being in the constellation Capricornis, the Goat.

The following are the visible eclipses, etc., of his Satellites for December:

Satellite I.

Occultation, dis, Dec. 2—7h. 6m. evening.
Transit, end, Dec. 3—6h. 27m., evening.
Transit, end, (shad.), Dec. 3—7h. 30m., evening.
Transit begins, Dec. 10—6h. 8m., evening.
Transit begins, (shad.), Dec. 10—7h. 6m., even.
Eclipse ends, Dec. 11—6h. 41m., evening.

Satellite II.

Transit ends, Dec. 9—7h. 8m., evening.
Transit begins, Dec. 16—6h. 58m., evening.
Eclipse ends, Dec. 18—6h. 8m., evening.

Satellite IV.

Occultation, disappears, Dec. 27—6h. 13m., even.

At the time of the occultation of Satellite IV, the Satellites will occupy the positions shown in Fig. 1. The dot representing the Satellite is placed on that side of the number of the Satellite towards which the Satellite is apparently moving.

SATURN is the most favorably situated of the planets, passing the meridian as follows:

Dec. 5—6h. 51m., evening.
Dec. 15—6h. 13m., "
Dec. 25—5h. 35m., "

He passes the meridian at 6 o'clock in the evening, Dec. 18, being then 90° east of the Sun. He will be about 7° south of the Moon Dec. 3 and 30. His largest Satellite, Titan, may, with a very small telescope, be seen east of Saturn until Dec. 2, and after Dec. 18, being farthest from the planet Dec. 26. He will be west of the planet Dec. 2–18, being farthest west Dec. 10.

URANUS presents no features of interest to the telescopist, as he merely presents a faint bluish disc, when the most powerful telescopes are brought into requisition. When brightest (which will be in February, 1879) he may be seen with the naked eye, provided his situation is known. With an opera g ass he may be seen about 6° east and 2° south of the brilliant star Regulus, in the handle of the Sickle in Leo. (We say "Leo," but the head of the Lion, which is represented by the Sickle, is in the constellation Cancer, the Crab). Uranus rises as follows:

Dec. 10—10h. 28m., evening.
Dec. 25—9h. 28m., "

NEPTUNE, when brightest, may be seen with a telescope of 2-inch aperture, using as high a power as such an instrument will bear. He is moving westward among the stars in the western part of the constellation Aries, the Ram, passing the meridian as follows:

Dec. 5—9h. 24m., evening.
Dec. 15—8h. 44m., "
Dec. 25—8h. 4m., "

Fig. 2 shows the position of Neptune with respect to the surrounding stars. He may be known from the neighboring star by having a paler and steadier light. His position will not vary perceptibly from this for several weeks, as his apparent motion is very slight.

METEORS OR SHOOTING STARS.—There seems to be one one well-marked shooting star epoch in December—Dec. 6-13. We believe its period of maximum display is not known. The constellation Gemini is their radiant point. The centre of Gemini rises Dec. 15, 6 P. M., and passes the meridian at 1 A. M. Hence if any meteors are seen in early evening they will shoot upwards from the eastern horizon.

THE

YOUNG SCIENTIST.

PUBLISHED MONTHLY.

Past and Future.

TO-DAY we stand on a dividing line which marks a notable division between the past and the future; between accomplished fact and prospective hopes. The number now issued completes the first volume of the YOUNG SCIENTIST, and fills our contract with by far the greater number of our subscribers. On looking over the pages of the twelve numbers which we have issued, we feel that it would be difficult to procure elsewhere for the small sum of fifty cents, an equal amount of matter of the same quality. We have spared no expense for either articles or illustrations; the question with us has never been, "What will the article cost?" but "How good is it?" and although the journal is still very far from our ideal of what it ought to be, yet we feel that we have no reason for discouragement.

Next year, however, we hope to effect notable improvements in every department. We have in our pigeon holes several articles of great value and interest, and we have the promise of more. These articles will be illustrated by the work of the best draughtsmen and engravers in the country, and, as we have already announced, each number will consist of sixteen pages instead of twelve as heretofore. We feel confident, therefore, that those who join us on the voyage of 1879, will have no reason to regret it.

That the YOUNG SCIENTIST was needed, is abundantly proved by the deep interest which has been manifested in its success. Its circulation has already reached that of many much older journals, and the strong hold which it has taken upon the kindly regards of its readers, is shown by the fact that we have upon our books several subscriptions for two or three years. We fully appreciate this confidence and liberality,

and will do our best to render a proper return by making the journal as good as possible.

Our readers must, however, bear in mind that the more subscribers we get the greater will be our power to give them a good thing, and therefore we trust that every subscriber will not only renew his own subscription promptly, but endeavor to get some of his friends to join him. Our club rates are liberal, and our premiums valuable; we ask no one to work for us for nothing, and we look forward to an enormous subscription list during 1879.

But however this may be, we thank all our readers for the support they have given us during the past year, and we wish them all "A MERRY CHRISTMAS AND HAPPY NEW YEAR."

A Word to Parents.

IT is an unfortunate fact that the country is flooded with juvenile literature which, if not of a depraving kind, is, to say the least, debilitating to young minds. No boy whose mind is filled with dime novels, and whose feelings and imagination are excited by the false romance and adventure therein depicted, can possibly be in that healthy intellectual condition which gives promise of success either in work or study. And yet we find on every hand books and papers of this exciting kind. In the city of New York alone, it is said that there are twenty-five boy's papers of this class; and to crown this horror, a clergyman in a neighboring city announces a book devoted to "Night Sides of City Life," *illustrated*, and published at a price—fifty cents—which places it within the reach of every boy. Already one firm has ordered five thousand copies of this book in advance of publication, thus showing that a large circulation is expected amongst families and the young.

No teacher of youth, and no parent of thoughtful experience can fail to see that this book will do more harm during the next year than the author will be able to do good during the remainder of his life. And it is a matter of congratulation that such a volume is not to be published in New York, bad as this city is said to be, but has to issue from the press of a western and hitherto unknown publisher.

In view of these facts, the important question comes up—How shall we counteract the effect of this vile literature? To this question every religious teacher will, of course, have an obvious answer, but it seems to us that there is another influence which cannot be safely overlooked, and that is the influence of useful and instructive occupation. Give the boys something to DO in their leisure hours. Mere reading is not enough. They must have work in which they are interested, and in this connection it is well to remember that the education of the hands is quite as important as the education of the mind. Therefore, give them tools and teach them how to use them. Let them make work-boxes for themselves and sisters; kites and boats for themselves, and ornamental and useful articles for the household. Let them learn how to work out new designs for these things, and how to copy old ones. Once they become interested in these things and attain a certain measure of success, dime novels and accounts of night adventures in the city, even though these adventures be by a minister, will become stale and insipid.

To teach the boys (and girls too) the use of tools and simple instruments, such as cheap microscopes, telescopes, etc., is the aim of the YOUNG SCIENTIST. We believe that the antidote we have pointed out is one of the most efficient, and we propose to do our part to place it within the reach of all.

A Simple Method of Copying Drawings.

The following is a simple and easy way to obtain copies of drawings. If the drawing is in a book, or is one which it is desirable that it should not be defaced or injured, it will be necessary first to make a tracing of it, which is done in the following manner: Take a piece of tough vegetable tracing paper, such as may be obtained at ordinary book stores, and cut it so that it will be about an inch larger all around than the drawing. Lay it over the drawing, and with a moderately hard pencil trace over the lines which it is desired to copy.

Now take a piece of the same tough tracing paper, half an inch smaller than the tracing, and lay it on a smooth elastic surface, such as

is formed by several thicknesses of writing paper laid together. Mark over the surface of this tracing paper with a very soft lead pencil, so as to cover it completely with the pencil lines, with the exception of a small margin around the edges. With a small piece of wash leather or chamois skin, rub over the penciling so as to blend the lines, but not hard enough to rub off the lead. This prepared tracing paper is the transfer sheet.

Lay the tracing on the paper on which the copy is to be produced, and mark where the corners of the tracing come, so that it may be again placed in the same position. The transfer sheet must now be laid on the paper, inside of the marked corners, and with its penciled side down. The tracing can then be laid in its proper position, and fastened temporarily with pins or thumb tacks. With a sharp-pointed, very hard pencil, go over the lines of the tracing, using a moderate pressure, and being careful that no lines are missed. On removing the tracing and transfer sheet, a copy of the tracing will be found on the paper.

The copy thus obtained can be used as a ground work, and can be reinforced as much as the draughtsman may wish.

This method of transferring is better than that with the ordinary manifold paper, especially if it is desired to work over the copy with india ink, because the lines being the same as ordinary pencil lines, do not interfere with the flowing of the ink, and they can be easily erased, while the ordinary manifold paper being prepared with lard or oil, leaves an oily line which prevents the ink from adhering to the paper.

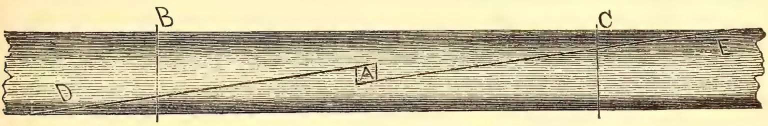
In many cases the drawing which it is desired to copy can be used instead of the tracing. The transfer sheet, being black on one side only, does not soil the back of the drawing.

The transfer sheet can be used a number of times, and if the lines grow dim it can be penciled over again.

The Shoulder and Collar Wedged Spliced Joint.

For permanent, or glued up and tied joints, this splice appears to be first-rate where the cane or wood is of sufficient thickness to allow such a joint to be made. The spliced rod is shown in the accompanying sketch; also the wedges fo- the hole, A. The ends of the

wedges are to be cut off when the splice is firmly wedged. If the splice is to be glued up as a permanent one, it must be closely tied with waxed silk or fine thread, and varnished. If used as a movable one by the riverside, a slightly tapered ferrule must embrace the rod from B to C, fully covering each end of the joint. This splice, also, might be used in the joints of a rod not permanently glued up and tied (all being secured by a sliding ferrule), if the fisherman chose to be at the trouble of punching out the wedges at the end of a day's fishing. Metal wedges might be advantageously used, if properly made of true exactness to fit the square hole in the centre of the splice.—*Exchange.*



THE SHOULDER AND COLLAR WEDGED SPLICED JOINT.

Fire-Proof Dresses.

At this season, when tableaux, private theatricals and similar entertainments, bring together light dresses and bright lights, it may be useful to know how to render even the most gauze-like dress perfectly uninflammable. By the use of the means now at the command of science, many a valuable life might be saved.

Some years ago Queen Victoria appointed a commission to investigate this subject. It was found that there were but four salts which were applicable to light fabrics: 1, Phosphate of ammonia; 2, a mixture of phosphate of ammonia and chloride of ammonia; 3, sulphate of ammonia; 4, tungstate of soda. Of these, the best was tungstate of soda, a salt which is not

by any means expensive. Sulphate of ammonia is objectionable, from the fact that it acts on the irons and moulds the fabric. The tungstate of soda is neither injurious to the texture or color, or in any degree difficult of application in the washing process. The iron passes over the material quite as smoothly as if no solution had been employed. The solution increases the stiffness of the fabric, and its protecting power against fire is perfect. This salt offers only one difficulty, viz.: the formation of a bitungstate, of little solubility, which crystallizes from the solution; but it was found that a very small percentage of phosphate of soda rendered the tungstate quite stable. The best method of applying these salts is to take one ounce of tungstate of soda and a quarter of an ounce of phosphate of soda, and dissolve them in a quart of water. The goods are moistened with this solution before being starched, and they may be afterwards ironed and finished without the least difficulty.

Articles prepared in this way are perfectly uninflammable. They may be charred by exposure to fire, but they do not burn readily unless there is some extraneous source of heat, and they can not be made to burst into flame. By the aid of this discovery, a lady dressed in the lightest muslin might walk over a row of footlights, and the only result would be that the lower part of her dress would be injured. Unless her person actually came in contact with the gas flames, she herself would suffer no injury. In country places, where tungstate of soda cannot be procured, a mixture of three parts borax, and two and a half parts sulphate of magnesia, in twenty parts of water, may be used with good effect.

Hints on Filing.

Cleaning the File.—The dust or small particles removed from the material operated upon, are always more or less liable to clog and fill the teeth; this tendency is especially aggravated when the file is used upon wood, horn, and such other materials, as, upon being mixed with the oil in the teeth, become baked when dry, and thus prevent the teeth from penetrating the work, to say nothing of the appearance of being worn, or the tendency to injury from rust.

It therefore becomes necessary that the file should be cleaned, not only at intervals during its use, but carefully before being laid aside, if the best results are to be attained.

This cleaning is done in several ways; sometimes, in the finer files, by rubbing the hand over them, or by drawing them across the apron of the workman; at others, by striking their edge upon the bench or vise, and again (which is a more common method upon the larger files), by the use of a strip of old or worn out card clothing, tacked to a piece of wood, having a handle shape at one end—a device which is usually rudely constructed by the operator.

In removing oil from the teeth of a new file, a ready way is to rub chalk or charcoal across the teeth and brush thoroughly. By repeating the operation a few times, the oil will be entirely absorbed, and the file will be in its best possible condition for use upon cast iron.

When the teeth of files are clogged with wood, or other soft substance which has become baked into them, if held in boiling hot water for a few moments, the imbedded substance becomes so loosened, that it may easily be carded out of the teeth. If the operation be quickly performed, any moisture remaining will be readily evaporated by the heat retained in the file.

Care in Putting Away.—One of the most destructive customs among a large number of mechanics of the present day is that of loosely throwing their files, fine and coarse, small and large, into a drawer filled with cold chisels, hammers, turning tools, etc., and then throwing the chisels, hammers and other tools on to the files.

Now when we consider the small portion of the points of the teeth which is worn off by use in an extreme wear, and that to effectually dull them for some kinds of work requires but the slightest rubbing upon a hard substance, it will be easily seen that the evils of this habit should be more carefully considered, and suitable provision made to avoid its destructive tendencies.

Starch Paste.—Two ounces of starch, one ounce of white glue, half an ounce of acetic acid, a few drops of oil of cloves. Dissolve the glue in cold water and then boil. Mix the starch with cold water, and pour into the glue while boiling.

To Polish Steel and Iron.—It is a fact well known to chemists that potash and soda, particularly the carbonate of the latter, prevent rust in iron. Mechanics are also well aware that cutting tools moistened with soap, leave a much cleaner surface on iron than when dry or used merely with oil or water. These facts have led to the use of a mixture of emery and soap, with excess of carbonate of soda, for polishing steel and iron, and the results have been very satisfactory.

The Population of the World.—The latest edition of Behm and Wagner's "Bevolkerung der Erde" gives the present population of the earth at 1,439,000,000, as compared with 1,424,000,000, as given in the previous issue. These figures are based upon the most recent censuses taken in various countries. The population is divided as follows: Europe, 312,398,480; Asia, 831,000,000; Africa, 205,219,500; Australia and Polynesia, 4,411,300; America, 86,116,000.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL FOR AMATEURS.

VOL. II. NEW YORK, JANUARY, 1879. NO. 1.

Growing Plants in Sleeping Rooms.

MANY persons who have no opportunity to cultivate a garden, are so fond of living plants that they cannot get along without them; they therefore grow them in pots in the rooms in which they live and sleep, and we confess that during the dull days of winter, when everything outside is reduced to dusty brown or clothed in white, a little bit of green is wonderfully pleasant and refreshing. This window gardening or house-plant culture, is generally confided to the girls (and by the way, we like that hearty old word which indicates so much that is pleasant and lovable, as contrasted with the modern expression "young lady."). Their refined taste and patient attention enable them to succeed and make things pleasant where boys too often fail. It frequently happens, however, that some big brother, fresh from the chemical or botanical classes of school or college, wants to have the plants all turned out of doors or pitched down cellar, and he so overwhelms his less scientific sisters with talk of carbonic acid, carbonic anhydride, oxygen, ozone, etc., etc., that however the tears may come, the plants have to go.

Now before putting the edict of banishment into effect let us see whether all this argument and these

"Words of learnéd length and thundering sound"

really furnish good sound reasons for depriving the girls of their pets.

It is well known that plants are the great agents in keeping the air pure and wholesome for animals. Whenever an animal breathes, it gives off carbonic acid, and this carbonic acid (called also carbonic anhydride and carbonic di-oxide,) quickly extinguishes life when it is present in too great proportions. Hence, when animals are confined in close boxes or apartments they speedily fall asleep and very soon die. Under the influence of sun-light, however, the plants absorb this carbonic acid; they decompose it into its component parts, oxygen and carbon, and while the latter is used for making starch, sugar, woody fibre and other parts of the plant, the oxygen is given out and serves to make our fires burn and to enable animals to breathe. It is only by the help of light, and strong light at that—such as the light of the sun or burning magnesium, that plants are en-

abled thus to decompose carbonic acid. During the night they give off a part of the carbonic acid which they absorbed during the day, and which for want of light, they are unable to decompose; and therefore it has been held that plants must be injurious when kept in sleeping rooms.

But while it is quite true that plants give off carbonic acid during the night, the extent to which they do this is so slight, that it may be safely overlooked, especially when we remember that there are so many other agents of far greater power, at work in the same direction. A common student lamp gives off more carbonic acid during the night than would a whole houseful of plants. Even a candle will give off more than would be exhaled by all the plants in the conservatory of the most ardent lover of flowers. A child, breathing for five minutes, will throw off more carbonic acid than a windowful of plants would do in a week, and yet who ever was afraid of staying in the room with a child? The injury which even a large collection of plants is capable of doing to the air is as nothing compared with that to which the presence of a strong, healthy man gives rise. Indeed if there were any foundation for fear on this score, a greenhouse or conservatory would, towards morning, become one of the most deadly places a person could enter; yet who ever felt inconvenience from a walk through a conservatory in the early morning? And how refreshing is the air of such an apartment when compared with that of a ball-room where the dancers have been in active exercise, and consequently have consumed the oxygen with more than ordinary rapidity!

We may therefore safely conclude that on this ground, there is no valid objection to the presence of plants in sleeping or living rooms.

There are, however, certain plants which give off powerful odors, and which should be carefully avoided. It is impossible to give a list of plants which are objectionable on this score, for it has been found that different constitutions are differently affected in this respect —plants which are entirely harmless to some being almost deadly to others. The rule ought therefore to be to exclude *all* plants which give off a strong odor, either through their leaves or flowers. If this rule be strictly adhered to, no danger will be incurred.

The Art of Bust-Modelling and Casting.

BY ADELAIDE F. SAMUELS.

THE first day you can do nothing but prepare the clay, which can be procured at any Italian image-caster's shop for two or three cents a pound, and fifty pounds will be sufficient to make a life-sized bust, with drapery.

Preparing it, or setting it up for the bust, is the only disagreeable feature in modelling; all artists agree to that.

The clay is set up in the following manner: Wet the top of your modelling-stand—if you have not one with a revolving top, an old shoe box on end will answer the purpose—then with a wooden mallet, *pound* upon it your clay, piece by piece, until you have a *solid mass, without flaws*, as high and as broad as you intend your bust to be. The clay must be neither too wet, nor too dry, but just moist enough to cling readily together.

Now, if you are quite sure your clay is well pounded, you can cover it with a wet cloth and leave it over night to *shrink*, while you take a

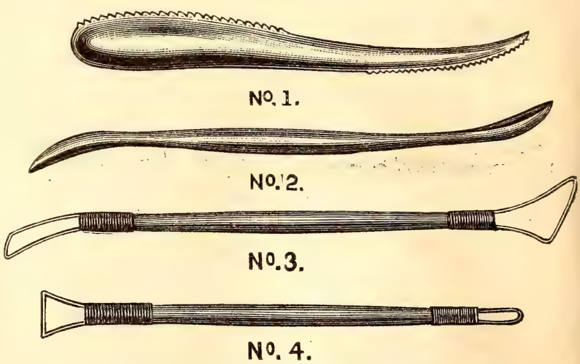


Fig. 1.—Tools used in Modelling in Clay.

look at some of the tools you will require, most of which can be made by any smart boy or girl, but if you prefer to buy them, they can be procured at the image-caster's, where you bought the clay.

Tool No. 1 is mostly used to get a *level surface* on the clay, by drawing the teeth repeatedly over it in *opposite directions*. It can be easily made out of hard wood.

No. 2 is also made out of hard wood, and is used to get a *polished surface* by pressing the spoon-like end upon the clay, and working the tool about in little circles; it is also used to "dig" with.

Nos. 3 and 4 are wires, bent, as shown in the figures, and *bound firmly* upon wooden handles; they are used to pick and dig with.

You will want, at least, two sizes of each kind, and besides them, a pair of dividers and a pair of calipers. The dividers or compasses are well known; the calipers must be large, and capable of being fixed at any distance apart by means of a set screw. The best form of this tool is drawn in Fig. 2. They should be at least a foot long. Those will be all the tools you will need for the clay, though you will see a greater variety at the image-makers.

Many persons suppose that the "Image-makers," as they are called, *design* the images they cast in plaster. That is a great mistake: very few, if any of them, do so. They are designed in clay first by artists; the clay model is then covered by a plaster piece-mould by the plaster worker, who can turn out a great number of "copies" in plaster from one mould before it is worn out. The artist usually gets a percentage on every copy sold, and sometimes, when an image is "something striking," it proves very remunerative both to the artist and the caster.

Nearly all the artists understand the art of

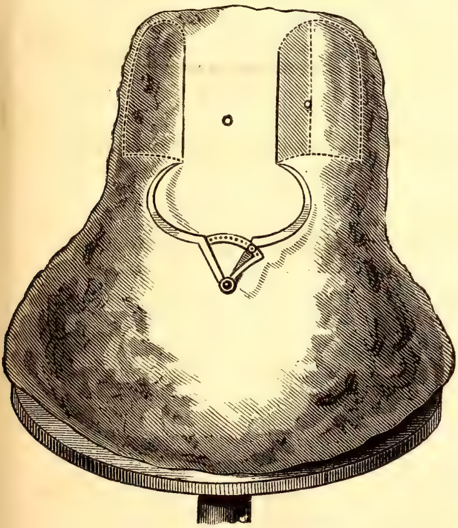


Fig. 2.

casting, but all seem to dislike working in plaster. You will be able to judge whether you will like it or not before you have finished this series.

The next day you can begin to take measures for the *profile*, which is always the first thing to be done in bust-modelling.

Unless you have a very true eye for outlines you will have to go by measurements almost entirely, and in order to have a point on your clay that you can measure from in every direction, you must first find the distance between the two ears of the sitter with your calipers, by placing the points on the fleshy knobs at the entrance of both ears; be very sure that the points *just touch* the flesh on both sides, but do not press it in, then screw up the calipers and you have your first measurement, which you will make use of in the following manner.

Suppose Fig. 2 represents the mass of clay as you built it up; it is, at least at the top, twelve inches thick; while, by placing the points of the calipers on a rule you find the sitter measures from ear to ear only, say, five and one-half inches.

Take the calipers, screwed up as they are, and mark with them two lines down the middle of the clay as represented in the cut, about as long as the face is to be, then make the dot between them, which will be where the end of the nose is to come.

Now, with the calipers measure the sitter from the end of the nose to the knob at the entrance of one ear. Take a large knife and cut away the clay carefully from both of the

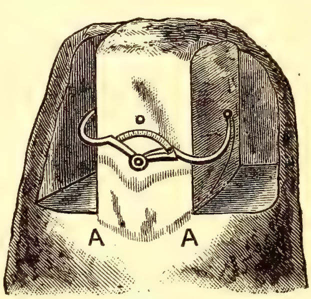


Fig. 3.

straight lines, as shown by the dotted lines in Fig. 1, until you can get both measurements on the clay—from ear to ear, and from the end of the nose to each ear.

If the face of the sitter is very full, so that the distance across any part of it measures more than the distance from ear to ear, you must allow for the fullness, as shown in Fig. 3, by rounding out the clay beyond the straight lines, instead of cutting it down even with them.

In order to get the screwed up calipers back

to take the ear measurements, without injuring the fullness on either side, place the points of them at A A, Fig. 3, where it need not be full, and run them back, then up, in the direction the dotted line takes.

Now, if you look at the sitter, you will see that the knobs at the entrance of the ears are not on a line with the end of the nose: they will doubtless be a trifle higher; stick a pin in the clay on both sides, just where the knobs should be, and you have your points to measure from in every direction, as shown in Fig. 4.

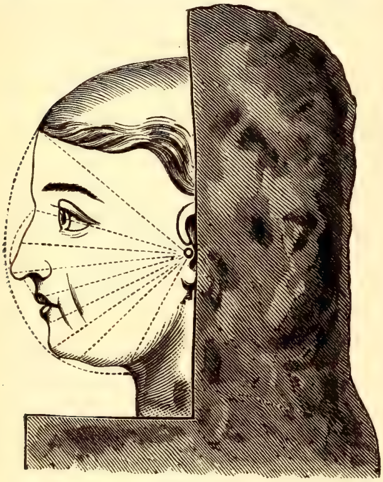


Fig. 4.

You have already the distance from the end of the nose to the ear; you next want to find the height from the end of the nose to the hair on the forehead with the dividers; mark the clay to keep the measurement, then with the calipers find the distance from the same point on the forehead to the ear, and work away the superfluous clay with tool No. 1, until you can make both measurements to a nicety.

Next measure the length of the nose with the dividers, then the distance from the top of the nose to the ear, with the calipers. While working away the clay for these measurements, you must look at the sitter's profile occasionally, to get the correct outline.

Now find the length of the upper lip, then its distance from the ear, and after working out those measurements, find the distance from the nose to the chin, then from the chin to the ear; and so on, as shown by the dotted lines; being very sure that you measure correctly, as the eighth of an inch, only, makes a difference in a likeness.

Put all the pieces of clay you cut off in a box by themselves, and water them occasionally; they will have to be used by and by. The same clay can be worked over and over for years, if kept free from dirt.

The clay you are modelling will need wetting by this time. If you have a syringe such as gardeners use to sprinkle plants with, you will have just the right thing to go over it with; if not, pour water slowly over it; it must be kept moist all the time or you can do nothing with it. At night, or when not working upon it, always keep it covered with a wet cloth, or, what is better, cover with oiled silk a frame that will just slide over the clay without touching it. That will keep the air from it, and does not disturb the clay as the wet cloth is apt to.

The modelling-stand must be in a *good light;* directly opposite a high north window is the very best.

To be continued.

Wood-Carving. III.

DIAPER-CARVING.

THE simplest of all kinds of carving is that known as "diaper-carving." The tools are simple and cheap, and the work easily learned.

One of the most suitable objects for this kind of carving is a book cover. In olden times books were generally bound with wooden covers, and hence the use of the word "board" as applied to the cover of a book. The books most suitable for this kind of binding are albums, scrap-books and books for dried plants or seaweeds. The carved covers give them an antique appearance, and hence the kind of wood that is chosen should have a flavor of antiquity about it. Black walnut and oak are good; avoid mahogany, rosewood and that class. Having procured a piece about a quarter of an inch thick that has a nice grain, solid and firm texture, and is dry and well-seasoned, cut out the pieces intended for the sides to exactly the size that is wanted Bevel off the edges and have the entire surface, except that intended for the inside, finely French polished. This you may be able to do yourself, but if not, any cabinetmaker will do it for you for a trifle. If you are easily pleased, you may rest content with a finely varnished surface, but the effect of French polish is so much superior in contrast with the rough diaper work, that you should secure it if possible.

The piece is now to be fastened to a good-

sized block of any common wood, so that it may be easily held during the process of carving. The carver generally has a few blocks of different sizes that he keeps for this purpose. They are planed smooth and true, but not oiled or varnished. To fasten the piece to one of these blocks or "working boards," as they are called, glue a piece of fine but stout white paper on each of the four corners of your blocks, and also a patch in the middle; then cover these patches with glue and press them on your working-board; and as soon as the glue is dry you are ready to commence operations.

Fix upon some simple pattern, which should have rather an antique cast. We give two of these as examples, Fig. 1 being complete, but greatly reduced in size, while Fig. 2 is nearly full size for a small book, but shows only one-half of the pattern. These patterns may be easily enlarged or reduced by means of the pantagraph—an instrument which every young

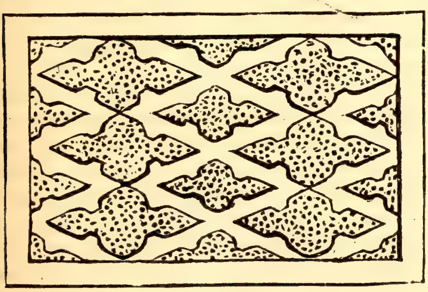


Fig. 1.

carver and scroll-sawyer should have. (In our next issue we will tell you how to make a much better one than you can buy.) Having selected your pattern and drawn it perfectly and neatly on good stout paper, trace it over on some tough tracing-paper; then pin it—or better, paste it—on the beveled edge of the block, so as to fix it firmly. Now take the tracing-point, and go over the whole pattern carefully, so as to leave a fine line everywhere. Remove the pattern, screw the board down on the table with your clamps, as described in former articles, and see that it is quite firm. Take the V, or parting-tool; hold it in your right hand at a

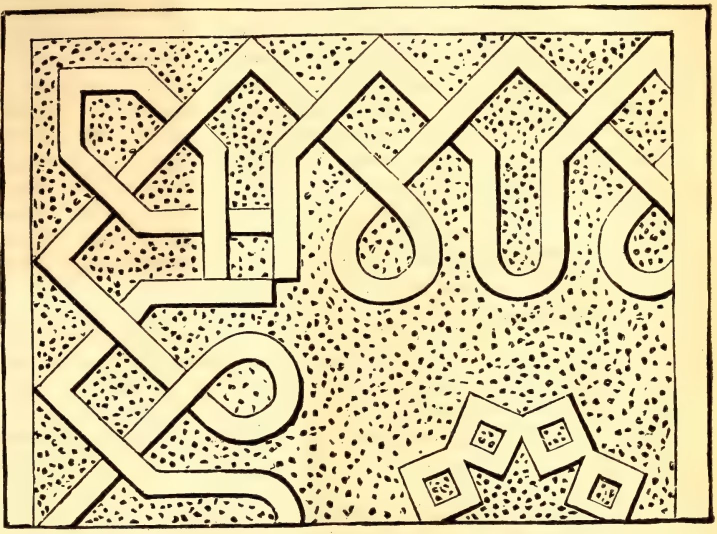


Fig. 2.

proper cutting-angle, put your left wrist on the wood to be operated on, pass your hand over the steel, the thumb underneath and the tips of the fingers resting on the work. This will give you perfect command of the tool, will prevent its slipping forward, enable you to guide it round the curves, and the thumb being under the tool, you can grasp it any moment with the whole hand. Take out no more wood than is just sufficient to mark the pattern well. Then take the star-punch, and hitting short, sharp strokes with the hammer, begin and punch down the wood as marked in the illustrations. While punching the wood, you must slightly turn the punch round after each stroke of the hammer, so as not to give the grounding a liney appearance; and one more caution—if you see that the punch raises little chips of wood, try the other way of the grain. When the work is finished, take a common table-knife, pass it between the piece of work and the board, and the paper will split in half easily, and the work will become detached. Scrape off the paper and glue, and the work is done.

The effect of this diaper-carving is very good, the punching down of the wood throws the pattern up in relief, requires but little care, and is easily done. You should practice a little with

the V tool on a spare bit of wood before trying it on your book-cover. The faults to be guarded against are cutting too deep, going off the line, not sweeping smoothly round the curves and punching to irregular depths, owing to variations in the force with which the punch is struck. You can, if you please, mark the straight lines with a chisel and the curves by a gouge, holding them quite upright, and pressing them down with the hand. Many persons do diaper-carving in this way without using the V tool. In our next paper we shall take up the subject of fret-cutting and perforated carving.

To be continued.

Engraving on Wood.

BY SARAH E. FULLER.

THE readers of the YOUNG SCIENTIST are no doubt familiar with the terms "Wood Cuts," or "Wood Engravings," and many probably know how they are made. But for the benefit of those who do not know, we will briefly describe them.

Examine any wood engraving, and it will be found to be made up of lines,—black lines and white spaces. These lines and spaces are sometimes so fine and small that they can hardly be seen without the use of a magnifier. Indeed the work is usually done with the aid of a glass, usually of low power. The white spaces are cut out of the wood, leaving the black lines in relief. No matter how fine the white line or dot, a fine tool has cut the minute chip out of the wood; and larger tools have cut out the larger white lines and spaces, different sizes being used according to the judgment and skill of the engraver.

All this will be more readily understood after a careful examination of the accompanying figures. In the first picture you will notice that the veins and network show white on a black ground. These have been cut out leaving all the black in relief. The second picture is the same subject; here, as before, the parts which show white have been cut out, but this time the veins and delicate lines of the network are in relief. And Figure 3 is an example where nothing has been engraved—a block the same size as the two preceding examples, but no work upon it.

Examine the illustrations of the YOUNG SCIENTIST and you will find them more interesting than before, for in order to make a good representation of any object, much thought and labor has been required.

Fig. 1.

As the name implies, a "wood cut" or "wood engraving," or "engraving on wood," is an engraving which is cut on wood. For fine engravings, boxwood imported from Turkey is used; this wood grows in the interior of the

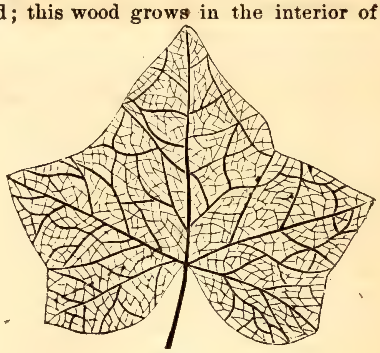


Fig. 2.

country, and is brought to the seaports on the backs of mules, in logs, the diameter of which seldom exceeds eight or ten inches. In our principal cities, there are dealers who make a business of preparing these logs for the use of engravers, and any boy or girl who wants to engrave, can have these prepared blocks sent by mail or express.

Boxwood is chosen for fine engravings because it has a close, even grain, permitting lines to be cut, without breaking or chipping out. When it is not essential that these lines shall be very fine, apple, pear, maple, cherry and mahogany woods are used. For large bill-posters pine boards are used, and tools especially adapted for cutting with the grain of the wood; but this form of wood engraving does not properly belong to our subject.

But for wood engravings such as you see in the YOUNG SCIENTIST and illustrated books, the pictures are made on boxwood, and on the end of the grain. The wood is sawed across the grain into slices, so that when smoothed and prepared for use, the slices are as thick as type is high, which is fifteen-sixteenths of an inch.

Fig. 3.

We will now suppose some boy or girl has a well-seasoned piece of any of the above named woods, sawed, and evenly planed and scraped to the right thickness. It is not necessary to plane both sides of the slices,—the sawing should be true, however. The next step will be to take a piece of pumice stone, with one side ground off flat. Grind the pumice stone on a brick or slab of stone, by rubbing it a short time. Wet the planed side of the wood, a little, and with the pumice stone smooth and polish the surface, being careful that specks of grit or the edges of the pumice stone, do not make scratches. Do not use too much water, or the block will swell and warp, and perhaps crack. Use just enough water to let the pumice stone pass easily over the surface. Use the pumice stone lightly, that is, do not bear down heavily on the surface, and when there is fine ground wood mixed with the water, rinse it off. If the surface needs farther rubbing, go over it with the pumice stone again, but do not work with a paste of ground wood and water accumulated on the surface—keep the block free. If the block has been well planed and scraped, the "pumicing" ought to be quickly done. The object is to remove any slight inequalities or shiny places left by the plane. While the block is yet damp, take some fine white lead, quite free from grit, and dust a little on the block, or use prepared water color white, or an enameled card may be rubbed over the damp surface and the enamel will come off. Then with your fingers distribute the white carefully over the whole surface, so as to make a very thin even coat of white—so thin that it will show the wood through it, while it is wet, and when it is dry it will be white enough. Set the block on its edge to dry—not near a fire, or in the sunshine—let it dry slowly. The blocks should always be placed on their edges, there being less danger of warping than if laid on their surfaces. We whiten the blocks because the pencil "takes hold" better than on the bare wood, and also because the drawing shows more clearly.

When the block is dry, the next step is to draw the picture or design on the wood. We have the design before us on paper, it may be a sketch only in outlines, or it may be a shaded picture. Cover the drawing with a piece of tracing paper, the best kind of which is very transparent. Fasten it so that it will not slip, the most convenient way is with yellow beeswax, several small scales being used. It is best to have the picture lying on a drawing-board, and fastened so there will be no danger of slipping while tracing the outlines. The points used by draughtsmen are very convenient, or mucilage or beeswax can be brought into service. Trace all the outlines of the picture on the tracing paper with a moderately soft pencil—the grade HB is very good. Have the point of the pencil long and sharp. After cutting it with a knife to the shape needed, the point can be finished by rubbing it on a piece of fine sand-paper, or a fine file. It may be repointed in the same manner, as often as is necessary during the process of tracing. After tracing the outline very carefully, loosen the tracing paper and lay it face downwards, on the prepared block. Fasten the edges to the side of the block, either with mucilage or beeswax, whichever is most convenient. With a metal or ivory point (an old-fashioned stiletto is good), or a hard pencil, retrace the pencil outline, which will show very distinctly against the whitened surface of the block.

DR. ABEL, the Berlin correspondent, has been lately staying with Lord Beaconsfield at Hughenden Manor. Dr. Abel is known to read and translate upward of seventy different languages, and though a German by birth, yet his English writing is clear in meaning, simple in diction, and polished in style.

Lessons in Magic.—III.

THIRTY years ago or more I attended the opening performance of Herr Alexander, a Magician, at the Minerva Rooms, which old New Yorkers will remember as a very pleasant hall, and there saw, for the first time in *my* life the "Obedient Card," which I promised in my last, to explain. It was an old trick then and, consequently, is not a very new one now, but it is good, and always "takes."

The performer asks five or six persons in the audience to select cards, and when they have been chosen and replaced in the pack he returns to the stage and lays the cards on his table. He then hands out for examination a small metal box, of such a size that a pack of cards will just fit in it. This box, the technical name of which is *card-rack,* is open at one end and partly open in the front, and has a piece of tubing soldered at the closed end. It is very much the pattern of a *faro box,* but as my readers may never have seen that dangerous plaything, and I trust never will, they can form an idea of what is needed by this illustration.

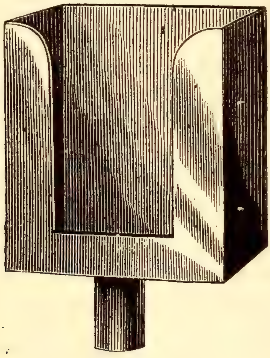


Fig. 1.

When the audience have been satisfied that there is no preparation about the box, it is stuck on the end of a pole, which is fastened to the stage, and the pack of cards is placed in it. Then as they are called out each card rises in turn from the pack.

The preparation for this is very simple: A piece of black sewing silk is fastened to the top of one of the first cards in the pack and then led over the top of the pack. The last of the cards selected by the audience is then forced down into the pack carrying the silk-thread with it. Then another card, and another, until all have been pushed into the pack, each carrying the thread with it. Between each of the chosen cards there are three or four others, and over the tops of these the thread always passes while it goes under the chosen ones. The loose end of the silk-thread is led off to a confederate who is concealed, and, it stands to reason, that when he pulls the thread the last card that was pushed down will come up and when he pulls again, the next will come, and so on till all have appeared. This prepared pack is laid on the table with several others, and after the *card-rack* has been examined and placed in position, this pack is taken up, instead of the one from which the cards were drawn, and placed in the *card-rack.*

The effect of the trick may be heightened in very many ways, as for instance: Among the cards that are drawn let one be a queen. When it is time for it to arise from the pack, the performer approaches the person who drew it, and requests him to tell it to "come up." This he does, but strange to say, no card appears. "What was your card, sir?" you ask.

"The queen of hearts," he replies.

"Ah, my dear sir, with a queen some little formality is required. Court etiquette demands other language than that in which common-folk are addressed. Let me see if I cannot persuade her to show herself. 'Will your gracious majesty condescend to honor this company with your august presence?'"

The card at once comes up, but feet foremost.

"See sir," you cry, "my politeness has brought her out, but to show her anger at your want of courtesy in addressing her, she comes up feet foremost. We will see, however, whether we can remedy it."

You take the card and place it again in the pack with its feet still uppermost, but are careful to put it among the front cards, and not near the thread. A duplicate queen has previously been arranged among the prepared cards, and when, turning towards the pack, you say: "Now will your High Mightiness be condescending enough to throw a somersault—under cover of the other cards—and appear before us in a manner more becoming the dignity of your station," the duplicate card appears, and nine out of ten in the audience imagine that in some way to them unknown you have really caused the card to turn over in the pack.

Another very pretty effect is that of mending the card. When the cards are first drawn, you ask one gentleman if he will be sure to remember his card. Of course he will reply "Yes."

"Very well, sir," you say. "I've no doubt

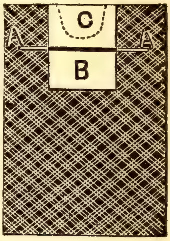
you think you will, but so many wonderful things are happening just now, that it is possible—understand me, sir, not probable, but merely possible—that you might even forget the card you drew. To guard against this I will tear a piece out of it, which I will give to you to hold." As you say this you tear a small semi-circular piece out of the top of the card and hand it to him. When the card appears from out of the pack the piece of course is wanting. You take it from the person who has it, and making a motion, as if throwing it towards the pack, the piece disappears from your hand, and at the same moment the torn card appears whole.

There are several ways of mending a card, each "magician" using that which he likes best, but the principle is the same in all, *i. e.*, a hinged piece, working on a spring and flying into its place at the right moment.

"Psha!" I think one of my young friends says, "there's another spring. I hate springs." But springs are very good in their place and in no place are they more useful than in mechanical tricks. The only trouble is, that in most descriptions of conjuring tricks, they are pressed into service when not absolutely necessary. If a trick is being explained the working of which the writer does not very clearly understand himself, the first thing you know, up pops a spring in your face. They are so handy, they save a deal of trouble and explanation.

But the spring in the "mended card" is a very simple thing, being nothing more than a piece of india-rubber, one of those long strings such as elastic cloth is made with.

I will begin, however, as I ought, and describe the whole arrangement. Take a duplicate of the card which you intend to force, and from one end of it, at about the centre, tear out a semi-circular piece. Next cut out a square piece of bristol-board, somewhat larger than the piece torn out, and on this paste the torn piece. When dry fit the piece back in the card and paste the lower part of the bristol-board to the back of the card. Fasten a piece of elastic cord to the back of the card in such a way that it crosses the piece of bristol-board. In the annexed illustration, which represents the back of the card, B is the piece of bristol-board, C the piece torn from the card, shown by dotted lines, as it is on the other side of the bristol-board, and A A the points at which the ends of elastic are fastened. Suppose, now you bend back the piece B until it lies against the back of the card; so long as it is held it will stay there, but the moment it is released, the action of the "spring" will force it in its place again. When about to exhibit the trick take the card, press back the piece B until perfectly flat, and push the card down into the pack (carrying the thread with it). If the thread is pulled so as to draw the card partly out, it will appear without the piece,



as the other cards will hold it back, but if drawn out a trifle further, until the piece is clear of the other, it will fly into its place and that so quickly, that the audience will not be able to see whence it comes.

The trick as I have described it, can only be done at the theatre, or if exhibited at a private soirée, the young magician will require to have part of the room set off for his stage, and not allow his audience to intrude therein. It may be arranged, however, so as to be shown under the very noses of the audience, and if the performer only has sufficient impudence it will not be detected. For this purpose we use a hair, instead of a thread. Get a dozen long black hairs from some lady friend and tie them together by the ends, until they form a string about a yard long.

The best knot for this purpose is that known as "the figure eight," and when neatly made is almost imperceptible. Arrange the cards in the same way as if for the thread, using the hair instead, and in place of having it carried off to the hands of an assistant, fasten the loose end by means of a bit of wax to an old-fashioned copper cent. Place your prepared cards on the table, and the cent at a little distance from them. On the same table have an ordinary glass goblet. After the cards have been drawn and replaced in the pack, return to the table and place them on top of the prepared cards. Take the goblet to the audience, and when they have examined it to their satisfaction, give it to the person whose card is to come up first. Go back to the table for your pack; pick up the cent with your right hand, and "palm" it, and with the same hand take up the pack. Approach the person who has the goblet and request him to hold it as high above his head as possible, "That all may see it," you say, but really that he may not see too much. Place the pack in the goblet, retaining the cent in

your hand. Rest your hand on your hip, or take hold of the edge of your coat. When you want the card to rise, turn the right side of your body very slightly, away from the goblet, which will, of course, pull the hair, and the card will come up.

As soon as it is fairly out of the pack, take it with your left hand and give it to the person who holds the goblet; beg him to examine it, and whilst his attention is engaged with it, you take the goblet and pass to the one whose card is next to come up. As your hair is now a trifle longer, you stand a little further off from him than from the first, but in every other respect you do the same as before. And so you go on until all the cards have arisen.

The object of fastening the end of the hair to a cent, is to save feeling for it, which you would otherwise have to do, as it is impossible to see it when lying on the table.

There need be no fear of the audience discovering the hair, as I have performed the trick very many times in a brilliantly lighted hall, and never been detected. You cannot, however, use the torn card when exhibiting the trick in this way.

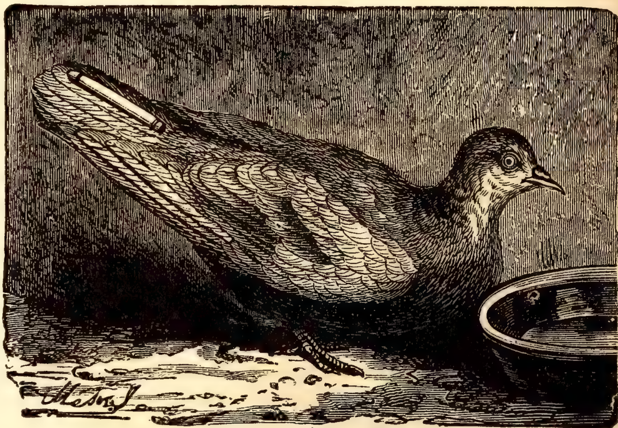
There remains but one thing more to explain in connection with this trick, and that is: how to make the audience draw the particular cards you want them to, so that they may correspond with those in the prepared pack. It is as easy as any part of the trick, but as the limits of my lesson are already reached, I shall have to defer that explanation until next month.

Microscopy.

The Microscope in War.

At first sight it seems strange that the microscope should find any direct employment in the conduct of warlike operations, but when we recollect the great importance of dispatches to the defenders of a besieged city and to their friends outside, there is no longer room for wonder. It was probably during the siege of Paris that the microscope was brought most extensively into use as an aid in transmitting intelligence.

Every reader of this journal has heard of the carrier pigeon, and knows that it is employed to carry messages from one place to another, but all are not aware, perhaps, that pigeons cannot be made to carry a message *away* from home; they can be used only for sending messages back from some place to which they have been carried from their own dove-cotes. Now during the siege of Paris it was easy for those who were confined in that city to escape by means of balloons, but it was impossible for those who were outside to get into the city. To convey information to the inhabitants,



Carrier Pigeon with Micro-Photograph.

those who escaped by balloons took with them carrier-pigeons, and these pigeons conveyed back the required information in the form of letters. That these letters might occupy as small a space as possible, they were first printed in large sheets, and these sheets were then photographed, but on so small a scale that the letters were utterly invisible to the naked eye. Indeed so small were they that a copy of a twenty-four page New York Sunday *Herald* might have been easily packed in a crow quill. These photographs were then rolled up, enclosed in a quill, and fastened to the bird in the manner shown in the engraving. When the bird reached its former home in Paris it was caught, the quill removed, and the photograph read by means of a good microscope.

The Social Science Association of Boston publishes the startling, if true, statement that several mills in New England are grinding white stone into powder, to be used in adulterating sugar, soda, and flour.

The Heavens for January.

BY BERLIN H. WRIGHT.

MERCURY will be brightest as a morning star, Jan. 16-19, rising Jan. 17, at 5h. 49m. morning—1h. 32m. before sunrise, and about the time twilight begins. He enters the constellation Sagittarius, the Archer, Jan. 14, and on the 17th, when brightest, will be 3° in that constellation; being in the center of the Milky Way and 3° north of the fourth magnitude star in the end of the handle of the Milkmaid's Dipper. He will be 3° north of the Moon Jan. 20, and set about 2½° south of the sunset point.

VENUS is still unfavorably situated for observation; setting Jan. 12, 5h. 31m. eve., and Jan. 31, 6h. 18m. eve. She will be in the constellation Capricornus, the Goat, throughout the month, entering Aquarius Feb. 2. The first magnitude star, Fomalhaut lies 16° south and 15° east of her. Her disc will be considerably smaller than at other times, as she is in the farther part of her orbit from the earth, and also farthest from the sun. Her phase will be gibbous, similar to the Moon's, when a few days from the full. She will be 2½° south of the Moon Jan. 23, and very close to Jupiter the same evening.

MARS is a morning star, and is moving eastward among the stars of the constellation Scorpio, being about 8° north east of the "fiery red" first magnitude star Antares the first of the month. He rises as follows:

Jan. 10, 4h. 46m. morn., Jan. 20, 4h. 40m. morn., and Jan. 30, 4h. 33m. morn. He will be 3¾° north of the Moon Jan. 19, in the morning.

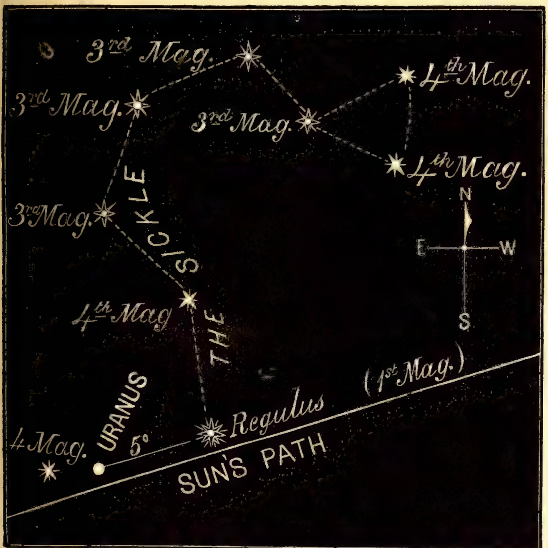
JUPITER will be about 2° south of the Moon Jan. 23. He sets as follows: Jan. 10, 6h. 38m. eve., Jan. 20, 6h. 12m. eve., and Jan. 30, 5h. 44m. eve. He is too near the sun to be viewed satisfactorily.

SATURN will be 1° south of the Moon Jan. 27. On the 26th, he will be exactly upon the equinoctial colure, from which right ascension (corresponding to terrestrial longitude) is reckoned, eastward, and 2½° south of the Earth's path, the ecliptic, which is also the sun's apparent path. He sets as follows: Jan. 10, 10h. 25m. eve., Jan. 20, 9h. 50m. eve., Jan. 30, 9h. 15m. eve. A good four-inch telescope will show all the satellites, when at their greatest angular distance east or west of the planet.

URANUS passes the meridian as follows:

Jan. 5, 3h. 26m. morn.	Jan. 20, 2h. 26m. morn.
" 10, 3h. 6m. morn.	" 25, 2h. 1m. morn.
" 15, 2h. 46m. morn.	" 30, 1h. 41m. morn.

As he is nearly at greatest brilliancy, we give in the annexed figure his position with respect to the surrounding stars. A person of good eyesight can see him, by thus knowing his exact position, without the aid of an opera glass or telescope. The observer must, however, choose a moonless night or at least when the moon is very distant from the planet. Jan. 7–15 and Feb. 3-11, will be unfavorable for observing, because of the nearness and brightness of the Moon.



The Heavens for January.

Before attempting to look for him, the eye should become accustomed to perfect darkness. It would be well for the observer to shut himself in a perfectly dark room for thirty minutes, keeping the eyes *wide open*, before making an observation, and in passing into the open air the eye should not be allowed to encounter artificial light. The Sickle is one of the most conspicuous figures in the heavens, and nearly every school-boy has traced its outline.

Neptune passes the meridian as follows: Jan 10, 7h. 0m. eve., Jan. 20, 6h. 21m. eve., Jan. 30, 5h. 42m. eve. (For figure showing his place among the stars, see YOUNG SCIENTIST for December, page 160.)

METEORS.—The following are the dates of the star-showers for January. Jan. 1–4, 18, showers of falling stars occur with more or less regularity upon these dates. It must be remembered that the earth may pass through these meteoric streams while it is day to us. In that case the inhabitants of the antipodes would witness the display. The radiant point of the last seems to be near the Northern Crown; of the first about 20° north of the same.

—There will be three eclipses this year; an annular eclipse of the Sun, Jan. 22; annular eclipse of the Sun, July 19; and partial eclipse of the Moon, Dec. 28. All of these will be invisible in North America.

THE

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This number will be sent to all old subscribers, whether they have renewed or not. Succeeding numbers will be sent to those only who have been entered upon our books for 1879.

Our New Volume.

In commencing a new volume of the YOUNG SCIENTIST it may be well to take a calm view of past success and future prospects. After the first year the progress of every journal settles down into a steady gait, and it is not difficult to determine the extent to which vigorous effort is warranted.

Although our circulation is still very far from what we expect it to be ultimately, we feel sufficiently encouraged to warrant us in securing the very best matter and illustrations attainable for our pages. We can therefore promise our readers the very best articles that can be procured, and by a better arrangement of our matter and the use of new type we expect to give more than even the promised increase of four pages. We therefore have no hesitation in calling upon our friends to exert themselves for us, for we intend to exert ourselves most earnestly for them.

Careful examination will show that the present number contains as much matter as eighteen pages of the numbers issued last year—an increase of quite one-half. At the same time our new, clear type makes not only a more readable but a more beautiful page.

Our Trial Trip—Back Numbers.

IN offering four numbers as a trial trip at a price *less than the yearly rate,* our sole object is to give to those interested an opportunity to examine the journal more fully than can be done by the inspection of a single number. We do not propose to supply a file of the journal at these rates, and neither do we propose to furnish a year's numbers in free specimen copies. Our January number is intended to be a fair specimen of the general scope and character of the journal for 1879, and will be sent to all who desire a specimen and the numbers for January, February, March and April, will be sent to those who subscribe for a trial trip. Other single numbers may be had for six cents each, and the eight numbers following the April number will be sent for 35 cents.

We have on hand a few complete sets for 1878, which may still be had for 50 cents, in loose numbers. We have also a few volumes with wide margins, handsomely bound with gilt titles, price $1.00, postage ten cents extra. The numbers for 1878 were not stereotyped, and the number on hand is now quite small.

Our circulation is now so great that we feel not only warranted but compelled to stereotype the pages of the journal. Full sets and odd numbers for 1879 will therefore be always on hand.

Things that are Old.

That the world moves and that knowledge increases have passed into proverbs. Nevertheless it is the experience of every one who has watched the history of the arts, that real novelties are scarce. Occasionally we have a new discovery which leads to entirely novel practical applications, but on the other hand many of the things which are brought forward as new, and which prove intensely interesting, are really old. In proof of this we may note that the readers of one of the prominent mechanical journals in England, have for several weeks past been deeply interested in the curious experiment known as the "Pneumatic Paradox," a singularly interesting and wonderful puzzle which occupied the attention of

the readers of the old *Mechanic's Magazine* fifty years ago.

Individuals as well as the ages have their cycles of progress, and what is old to the man of fifty is new to the boy of fifteen. Too often, however, the man thinks that what is an old story to him must be well-known to the boy, and he therefore neglects to give the boy the benefit of his experience. And yet if the boy would attain to the knowledge possessed by the man, he must pass through just this experience or something very similar. The time spent in discussing these old things revived is not therefore by any means lost, and we shall never hesitate to bring forward an old experiment, provided it is a good one. The firing of a cannon with an icicle is older than most of our readers, but it is just as interesting to-day as when first brought forward.

Rustic Wall Ornaments.

We had moved from the city into the country and within a short distance from the house was a stretch of woods where the children spent most of their time after school hours, collecting ferns, lichens, mosses, old nests of birds, etc., so that a great accumulation of these odds and ends of nature were on hand to be made up for home adornment and presents.

One of these, a group consisting of ferns, and lichen-covered branches, with nest and birds, was so greatly admired, that I have drawn and engraved it for the benefit of the readers of the YOUNG SCIENTIST.

It consists of a shield of wood three-fourths of an inch thick, six and a half inches wide, and twelve inches high, to which small branches thickly covered with a natural growth of lichens were securely nailed. The center and largest branch extended well out from the front of the shield. The face of the shield, between the branches, was covered with a small fungus of a grey and brown color, that grows in masses on old stumps. These were well dried in an oven before they were glued on, after which they were touched up here and there with bright green wood mosses.

An old nest of a blue bird, containing five eggs, was fastened to the largest branch, and beside the nest was a carefully stuffed hen bird looking in at the eggs. Above the nest was perched a male bird in the act of singing.

Next came the disposing of the dried ferns. Knowing that after being out of the press a few weeks they curl up and look unsightly, and are also apt to fade, I prepared a colored wax stiffening, composed of the following materials : one quarter of a pound of bright yellow beeswax, and half a teaspoonful of Canada balsam. These, when melted together, were poured into a large plate, well heated, so as to keep the wax melted. To this was added two parts of ground gamboge, and one part of best Prussian blue, ground to a fine powder with a table knife.

These pigments require a deal of grinding in the hot wax before the transparent, light, sappy green so desirable in coating ferns is obtained. The coating or stiffening had to be done very carefully in the following manner: Taking two thicknesses of blotting paper or muslin, I placed between them some

Rustic Wall Ornament.

of the prepared wax : then they were ironed over with a moderately hot flat-iron, till the wax flowed freely through the upper muslin. A frond of fern is then laid on, and over this another piece of muslin, ironing again, and adding more wax till the leaf was well soaked and covered with wax, after which the fern was taken out, and found to be coated evenly, and not too thickly so as to look clumsy. In ironing the climbing ferns, each leaf had to be done separately, and was afterwards held before a fire to slightly soften the wax, when each leaf was bent and shaped so as not to look flat and unnatural, as when they came out of the drying press.

Only well seasoned and woody ferns can be used for this work ; all thin and delicate ferns, such as the maiden's hair, are useless. Another advantage this wax stiffening possesses, is that dry colors can be rubbed on just the same as in wax flower work, so that the leaves need not be all of one uniform green. In ironing, I avoided pressing on the mid-rib or stem of the fern for fear of breaking it, and thus destroying its natural support.

Over the fungi and between the branches, I fastened small fronds of fern with pins. Toward the

top of the shield a mass of large ferns was fastened with a feathery dried grass, introduced here and there, which produced a very graceful pleasing effect.

The climbing ferns were used for festooning the leafless branches. As a balancing point to the bird singing, I fastened a cocoon of the *Attacus Cecropia* with the moth above it, as though it had just come forth. A few brilliant insects stuck on here and there in the way of finishing touches, completed this grouping of bits of Nature's odds and ends. *A. W. Roberts.*

To Pour three Different Liquids out of one Vessel.

Conjurers generally perform this feat by means of a bottle divided into compartments, but the young chemist can easily do it with very little preparation. Take three tumblers, and into one pour a very little (three or four drops) of a strong solution of acetate of lead; into another, a solution of sulphate of copper, and into the third, a little tincture of iron. The quantities of these liquids may be so small that they will not be perceived by those to whom the trick is shown. Then provide a pitcher (preferably of glass, because it is transparent and shows that there is no trickery about it), and fill it with water, in which an eighth of an ounce of prussiate of potassa has been dissolved. On filling the tumblers out of this pitcher, one will be filled with white liquid resembling milk; a second with a blue liquid, and the third with a dark red liquid. To those who see it for the first time, this experiment is very striking. The explanation is simple. The prussiate of potash (potassic ferrocyanide), is decomposed in all three cases, and white, red and blue compounds formed with the lead, copper and iron respectively.

To fire a Cannon with an Icicle.

Load a small cannon very lightly with powder, and prime it well. On the priming lay a small piece of potassium. If the priming be now touched with an icicle or a moist stick, the potassium will take fire and fire off the cannon.

In handling potassium, be very careful not to touch it with moist fingers or anything damp, or it will certainly take fire and produce very serious burns. Hold it with a pair of forceps or tweezers, (such as accompany every sewing machine), lay it on dry blotting paper, and cut off what you want. A piece the size of a grain of mustard seed is large enough.

An Acoustic Experiment.

Let a wide glass tube, open at both ends, be taken, and in this a piece of fine wire gauze be pushed up some little distance. If the gauze be now heated to redness over an ordinary Bunsen burner, and then removed, it will shortly emit a shrill note, lasting from five to ten seconds. The experiment will be new to most of our readers, and has the merit of always going off.

Drawing Boards for Amateurs and Students.

The best kind of drawing board for amateurs and students, is made of good pine without cleats or cross-pieces. The end cross-pieces usually put on drawing-boards are very objectionable, on account of the unequal shrinkage of the body of the board with the grain of the wood running longitudinally, and the grain of the cross-pieces which run tranversely, or at right angles with the former, always leaving shoulders or projections on the edges of the board, that prevent the accurate use of the T square. The most convenient size for a board is 27 inches by 21. This takes half a sheet of double elephant drawing paper, which will be found the best size for ordinary work, the smaller sizes being too light for finished mechanical drawing. And it will be found that a board of this size, made out of clean, sound and well-seasoned pine, will stand without any cleats or cross-pieces. It should be left quite plain and neither oiled or varnished.

The most important point is that the sides should be parallel, and that one of the ends at least should be at perfect right angles to the sides. This end should be marked and always placed at the left hand, and it is of very little consequence about the other end. But it will be found that it is not such an easy matter to get the end and sides square as some people think. Ask the majority of carpenters to do it for you, and they will fail. You must either do it yourself, or watch and guide them while they do it.

The best way is first to make one end perfectly straight. Never mind its relation to the sides; get it perfectly straight, and when you have it so, never touch it afterwards, but keep it for a guide or base line. The end being straight, make one side square with it. To find out whether it is square or not, you must not rely upon common iron squares, but you must test it with your T drawing square. And by the way, it is of no consequence whether the blade of this square is square with the stock or not; if the blade and stock are both straight, this is all that is necessary. For if you think a little, you will see that the angles in your drawing depend upon the board and not on the square. To test the board therefore, apply your T square to the side you are working on, draw a line across the right-hand end within an inch of the edge. Then apply the square to the left end, and draw a line across the center of the board. Try, by the ordinary rules of practical geometry, whether or not these lines are at right angles. If so your work is done; if they vary a hairsbreadth, plane off a little from the side, and try and bring them true.

Drawing paper should be mounted, for finished drawings (colored or shaded), but for common work it is more convenient to fasten it to the board with drawing pins or thumb tacks. Hence the necessity of having the board of soft wood; if otherwise, the pins will be blunted, bent, and difficult to press in and draw from the board; this operation can generally be done by the thumb nail.

PRACTICAL NOTES.

Ink.—In the recipes generally given for making ink, it is recommended to *boil* the ingredients. This is a very serious mistake. It should always be made with cold water. By this latter process, more time is of course necessary to make it; but then the ink is very superior, and entirely free from extractive matter which has no inky quality, and which only tends to clog the pen and to turn the ink ropy and mouldy. Take gallnuts, broken, one pound; sulphate of iron, half a pound ; gum acacia and sugar candy, of each a quarter of a pound; water, three quarts. Place the whole of these ingredients in a vessel where they can be agitated once a day ; after standing for a fortnight or three weeks the ink is ready for use. Logwood and similar materials, are often advised to be used in conjunction with the gallnuts, but they serve no good purpose unless it be to make a cheaper article which fades rapidly.

Clay for Modelling and Terra Cotta.—In answer to a correspondent, the *Druggist's Circular* gives the following information on this subject: Any kind of good plastic clay will answer, and it is of no consequence if it contains iron even in large proportions. Only it must be freed from stones and coarse sand by means of elutriation, and be well kneaded together to insure homogeneousness. A mixture of glycerine and water was at one time proposed to moisten modelling clay, so as to avoid the necessity of constantly wetting the models, but it is said that the process is unsatisfactory, as the clay on drying allows the glycerine to escape in drops. In technical parlance, it "sweats out." For *terra cotta,* clay containing too much iron is undesirable because, on baking, it assumes a glaring brick-red color. But a moderate proportion of the metal imparts to the finished objects a very pleasing color. Of course, glycerine is quite out of place in clay that is to be baked.

Varnishing Wood.—A good surface may be produced on unpainted wood by the following treatment: glass-paper the wood thoroughly as for French polishing, size it, and lay on a coat of varnish, very thin, with a piece of sponge or wadding covered with a piece of linen rag. When dry, rub down with pumice dust, and apply a second coat of varnish. Three or four coats should produce a surface almost equal to French polish, if the varnish is good and the pumice dust be well applied between each coat. The use of a sponge or wadding instead of a brush, aids in preventing the streaky appearance usually caused by a brush in the hands of an unskilled person.—*Artizan.*

Metallic Soap for Canvas.—The following is highly recommended as a cheap and simple process for coating canvas for wagon tops, tents, awnings, etc. It renders it impermeable to moisture, without making it stiff and liable to break. Soft soap is to be dissolved in hot water, and a solution of sulphate of iron added. The sulphuric acid combines with the potash of the soap, and the oxide of iron is precipitated with the fatty acid as insoluble iron soap. This is washed and dried, and mixed with linseed oil. The soap prevents the oil from getting hard and cracking, and at the same time water has no effect on it.

Tracing Patterns.—When a few duplicates of patterns for embroidery are required, they may be very easily made by hand as follows :

The drawing is made upon paper; then lay the drawing upon an even cloth, and perforate all the lines with a fine needle, close and even. Then take finely powdered charcoal, three parts, resin one part in fine powder; mix and tie it in a piece of porous calico, so that it forms a dusting bag. Lay the perforated drawing upon your material, hold down with one hand, rub the dusting-bag over the drawing; the dust will fall through the holes and form the drawing on the material. Remove the paper drawing, lay blotting-paper over the dust pattern, and go over it with a warm flatting iron. The heat will melt the resin and fix the drawing on the material.

Fire Kindlers.—A writer in the *New England Farmer* says that pine needles make the best fire kindlers he has ever used. In northern regions they may be gathered in the woods in any quantity, and if kept under cover and dry, they are far ahead of shavings, whittlings, etc. As they contain a very large proportion of resin, the suggestion deserves attention.

Superior Paste.—It is said that a paste made of seven parts of gum tragacanth and one part of gum arabic, with a few drops of oil of cloves, or diluted carbolic acid, will be found very reliable. It adheres strongly and does not turn sour like book-binder's paste, which is made of flour.

Soldering Fluid.—It is said that a solution of phosphoric acid in alcohol makes an excellent soldering fluid, which has some advantages over chloride of zinc.

BOOK NOTICES.

The Young Chemist.—A book of Laboratory Work for Beginners, By John H. Appleton, A. M., Professor of Chemistry in Brown University. Second Edition. Philadelphia : Cowperthwait & Co.

The importance of experimental illustration of the scientific facts brought to the attention of pupils, has been long acknowledged by all educators of intelligence. One good experiment is worth an hour's talk, and a single glance through a microscope at a good preparation is worth pages of description. Professor Appleton has therefore done a good work in endeavoring to smooth the path of teachers and pupils in this direction, but we wish he had brought the experiments within the reach of a wider class than he has done. While there are many valuable suggestions in the book, there are many points which might have been simplified, and although he says himself that one objection to the introduction of the experimental method is the cost of supplies, his apparatus is not always as cheap as it might be without reducing its efficiency. Side neck flasks and test tubes are very good, but it is not every teacher that can make them, and they can be procured only from dealers in large cities. Common test tubes, and what is called quill tubing, may be had from any druggist, and the teacher who cannot make gas-apparatus out of these and a good cork, had better not try to experiment. So, too, the leaden saucer used for preparing fluorine (page 30), must be procured from a dealer; while a saucer, equally good, might be made by the teacher himself, if a figure of it had been given.

The book is evidently intended for beginners, but does not always give them needed caution. The experiment under section 43, page 28, *might* be a dangerous one. It would have been well had the author been more explicit.

We welcome the book as a step in the right direction, but trust that the author will take an early opportunity to improve it.

Exchanges.

Yearly subscribers to the YOUNG SCIENTIST have the privilege of inserting three exchanges (or one exchange three times) during the year. This privilege is strictly confined to *exchanges; buying and selling* must be carried on in the advertising columns, where the charge is 30 cents per line. Each exchange is limited to thirty words, making about four lines, and in order to receive attention must be written on a slip of paper by itself. We file all letters received and have no time for copying out exchanges and queries.

As we desire to make the journal of the utmost value to *all* and not merely to serve the interests of individuals, we shall strictly adhere to these rules, which are certainly liberal, giving as they do advertising to the value of $3.60 free to each subscriber.

Groff's Model Suburban Architecture wanted in exchange for Nicoll's Railway Building, Templeton's Practical Examination of Steam and Steam Engine, and Colburn's Locomotive Engine. All entirely new. F. H. Jackson, Angelica, N. Y.

Wanted, a small turning lathe, state what is wanted in exchange. Ralph A. Pillsbury, P. O. box 555, Belfast, Me.

To exchange, beautiful rose, milk, greasy and smoky quartz, graphic granite, orthoclase, etc., for aboriginal relics, coins, or other minerals. Prof. C. L. R. Wheeler, Bedford, N. Y.

A collection of invertebrate fossils, accurately labeled and worth $225, to exchange for good microscope. The instrument must be of modern make, and in first-class condition. S. Calvin, Iowa City, Iowa.

A collection of foreign and dept. stamps, or a large collection of bird eggs of the Southern States, for a set of drawing instruments or books on plain and ornamental penmanship. Address Q. R. S., Mt. Pleasant, Washington, D. C.

Wanted almost anything in exchange for a complete set of cabinet maker's tools. The chest alone is worth twenty-five dollars. Address Mr. Clark, P. O. box 37, Brooklyn, N. Y.

For exchange, two good dial telegraph instruments, and two good Morse telegraph instruments, for printing press or bracket saw. James Scott, 20 Patchen ave, Brooklyn.

A card printer, type and cards worth $1.50, and the book "His own Master" will exchange separately or all together, books, or offers. Geo. R. Simpson, Janesville, Iowa.

A stationary cylinder steam engine, or hardware goods in exchange for an electric call bell. L. J. Otis, 973 Prairie Ave., Chicago, Ill.

Wanted for a good Gundlach No. 4 (¼) Objective, a 1½ or 2 inch Objective of wide angle. C. Onderdonk, Brooksburg box, Madison, Ind.

A spy glass costing five dollars, to exchange for a companion scroll saw and turning lathe in good condition. John Buck, Brazil, Clay Co. Ind.

Forty good photo-lantern slides, plain and colored, for a good printing press and outfit; or a small screw cutting lathe; or first class microscopic objectives, or offers. Wm. R. Brooks, Phelps, N. Y.

Wanted, a small rifle, in good order, bore 22-100, for a telegraphic key and sounder, instruments are made of brass finely wrought, mounted on a japaned iron base. Louis E. P. Smith, 6 Alpine st, Boston, Mass.

Ferns, mounted or unmounted, for Northern species of same. List of those on hand and those wanted sent on application. Maj. R. H. Wildberger, Ky. Mil. Inst., Farmdale, Ky.

Two good business lots, central, in Ellsworth, Kan, for good microscope, accessories and books, chemical balance, or gold watch. Wm. Zimmerman, 114 Dearborn st, Chicago, Ill.

To exchange, a collection of 500 rare stamps, with book which cost $1.50. The whole worth about $7.00. State offers. Albert N. Webster, 106 South Park ave, Chicago, Ill.

Hinkley knitting machine, worth $40, for a watch or breach loading shot gun, Harry Holden, Black Earth, Dane Co. Wisconsin.

One dozen (assorted) mounted objects for microscope, cost $2.50 (By J. W. Queen & Co.) for useful books on any subjects, or old U. S. coins. W. M. Stribling, P. O. box 350, Circleville, Pickaway Co, Ohio.

Cabinet mineral specimens, for Masonic publications, or other instructive books. Light reading not wanted. J. P. Clough, Junction P. O., Lemhi Co. Idaho.

Swiss watch lathe, brass, steel shaft and box, cost $25. Also a gear cutting lathe nearly complete. Exchange for minerals, microscopic slides and books. H. A. Cutting, Lunenburg, Vt.

Twelve dollars worth of parlor tricks, very best make, in exchange for a good microscope or a scroll saw with lathe attachment, of equal value. Prof. C. H. Houghton, Middleboro, Mass.

Book on magic, cost $2.50, for back numbers Young Scientist, and foreign stamps. Omega, Post Warrensburg, Mo.

Wanted, Parrishes Pharmacy and chemicals. State what is wanted in exchange. C. O. K., 1520 Fairmount Ave, Phila.

Stereoscopic views of New York city and vicinity, in exchange for fossils from the Western states and territories. T. P. Wendover, P. O. box 1862, N. Y. city.

Chemical apparatus or balance, spy glass or saw wanted, in exchange for novelty printing press, with sixty fonts of type. Alex, 151 East 33d st, N. Y.

Microscope worth $7.00, and cabinet with forty good slides; for better instruction or other educational apparatus. Particulars on application. Arthur Hobart, Penn Yan, N. Y.

Wanted a copy of Bourne's Treatise on the Steam Engine, for a full set (7 vols. bound) of Technologist, cost $19.25. W. J. Allen, 256 Twenty-second st, Bkyn.

Wanted, a three wheel "velocipede" large size, state what is wanted in exchange. Peter J. Murray, box 743 Wilkesbarre, Pa.

To exchange, one Bunsen and two Smee batteries; for books on electro-metallurgy or quantative or qualitative analysis. A. W. Palmer, care of Watch Co. Springfield, Ill.

A pistol in good order, cost $3.00, in exchange for an electric bell. A. W. Honywill, 217 Cabot st, Boston, Mass.

Collection of over 500 rare stamps, including Ecuador Cape of Good Hope, Barbadoes, Honduras, etc., in exchange for microscope, minerals, or scientific publications. Jas. G. Kitchell, 345 Race st, Cincinnati.

Music box, printing press, cost $35, and complete outfit for cutting stencil plate for marking clothing, cost $25, for boiler large enough for ¼ horse power. Geo. A. Battles, Westminster, Mass.

Three-quarter portrait camera tube, with box and tablets all new; for books on science, medicine, history, or travel, or microscopic slides. J. S. Mason, Medina, Ohio.

Wanted, a printing press or set of draughting instruments for a C cornet (worth $30.00) or Queen's Universal Household Microscope and accessories. G. E. T., Box 475, Westboro, Mass.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL FOR AMATEURS.

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A Tale of a Tub.

THIRTY years must have passed since I set up my first aquarium. I had always a special fondness for birds, flowers, fishes and insects. To me a snake was as wonderful and beautiful as a golden carp or goldfish, as they are commonly called. And as at this time I was put in charge of the cows, to take them to the woods, watch them all day and return them at night, I was happy beyond all boys.

The cows were given fresh water every evening from a half butter tub, that had been in use for this purpose, for several years. One day I fell desperately in love with this tub, and I determined to possess it at any cost,—it was so beautifully moss-grown outside, and inside it was lined with what seemed to me the finest of velvet or plush, of a beautiful green color, only the nap was longer. I struck a bargain with my father, which was to the effect that I was to weed and thin out the long carrot bed, and the tub was then to pass into my possession. In due time I accomplish'd my task and the tub was mine. Now for this beautiful tub and what became of it.

Instinct (for it could scarcely be called reason) directed me to place it under a grape vine, where it obtained the same amount of light to which it had been accustomed when standing in the cow's yard. I then filled it with water and placed in it eight fresh-water minnows, of about three and half inches in length.

Every day for a month, I fed them on angle worms cut up, and they throve amazingly. But one day I forgot all about the tub and the fish, nor did I think of them again for some two months, till one day when looking for a pet tortoise that had strayed away, I was greatly surprised to find my minnows all alive and as plump and frisky as ever. So far as I could see, but little change had taken place except that the nap on the green velvet had grown longer. I was thoroughly mystified. How had the fish lived in the same water so long without its being changed? How had they lived so long without food? I was still more astonished, however, when, my conscience smiting me for leaving them to starve, I offered them a bountiful meal of tenderest angle worms, and they

didn't seem at all delighted, but turned up their noses, so to speak, at the delicacies offered them! I could not make it out, and it was of no use to ask any of my friends about it, for they took no interest in my "pollywog" collections, as they called them. So I was left to my own conclusions, and child-like they were.

I had been reading about fairies and fairy lore, and had become greatly interested in the accounts of the curious fairy circles that the Irish people reverence so much. So I made up my mind that in the woods or neighboring fields there existed a fairy circle. The fairies thinking well of me, because I thought well of the birds, flowers and insects, had, during my absence, taken care of my tub of fish. And in truth some wonderful and silent powers combining together had been the means of saving my fish, as I found out in after years. In this, my first aquarium, there was a perfect balance of the three great powers—sunlight, oxygen, and carbonic acid gas, acting in harmony with the animal and plant life present. I had thus established one of the most perfect self-sustaining aquariums I have ever possessed.

The philosophy of a self-sustaining aquarium is very simple when once understood. Its laws can never be changed, turned aside or gained by short cuts; and this tub aquarium will give us every rule that is required to run a self-supporting aquarium successfully.

The proportions of the tub, seventeen inches across the top (inner measurement) and eight inches deep, was excellent for exposing a large surface of the water to the atmosphere, thereby enabling the water to absorb oxygen from the atmosphere. The depth of water was just right to allow sufficient light to pass into all parts of the tub, for the growth of the plants, and the situation was such that the sunlight was not in excess, so as to overheat the water. These were three very important conditions gained at the start.

The green velvet-like substance that lined the tub, is one of the very best oxygenating plants known for an aquarium, and the number of fish was rather under the proportion that could be sustained by the same amount of water and plant life.

Without the green velvety lining, which consisted of a plant known as conferva, and which throws off large quantities of oxygen, the fish could not have existed in the tub over a week, and would have shown great distress, hugging the surface water for absorbed oxygen and breathing in air from above the surface of the water, till their lungs became diseased and in course of time, sickened and died.

To prove that this conferva does produce oxygen in large quantities, take the fish out of the tub and place it in strong sunlight, to stimulate the conferva to grow and breathe more rapidly. In an hour's time a froth will be seen forming on the surface of the water and adhering to the side of the tub, and a slight hissing noise will be heard. Looking very closely into the water, strings of what seem like minute silvery beads may be seen streaming from the conferva. These bead-like streams are oxygen gas thrown off by the conferva in the act of breathing. The froth on the top is an accumulation of these beads or bubbles. The hissing noise is the bursting of the bubbles of oxygen—all going to prove that the water is thoroughly charged.

If the reader should wish to prove that this gas is oxygen, it may be easily done by scraping a little of the conferva off the side of the tub, and performing with it the curious and interesting experiment described in the YOUNG SCIENTIST for August, 1878.

All animals breathe this oxygen, and cannot exist without it. As the minnows by opening and shutting their mouths cause the water to pass through their gills (which are their lungs) the oxygen held in suspension in the water, comes in contact with the carbon of their blood, and forms carbonic acid gas, which is poisonous to animal life.

As this gas is very easily dissolved in water it does not readily pass off in bubbles, but the water becomes so charged with it that if there was no provision made by nature for getting rid of this gas, all the fish and other aquatic animals would die. But strange as it may seem, if it were not for this gas, so poisonous to animals, all our beautiful flowers, trees, and aquatic plants would perish. It is this carbonic acid gas that the conferva utilizes in breathing through the stonata or lungs, exhaling that which is of no service to it (oxygen) but which the fish need to live on. And as it goes on, day and night, the plants performing silently miracles of work for their friends the fishes, and the fishes breathing out bountifully food for their neighbors the flora. How did the fish live without food?

They did not; Nature supplied them with the choicest diet. Over the tub grew a grapevine; on the leaves of the vine, the cane, the

fruit and the very tendrils, swarmed myriads of creeping things, flocks of aphides tended by their herdsmen the ants, vine sappers, lady bugs, crickets, etc. Was it not the easiest thing in the world for some of them to tumble into the tub? Then there were thousands of anxious mother mosquitoes looking for just such a watery spot on which to construct and launch forth their egg boats; could minnows ask for finer food than fresh laid mosquito eggs? And it is not improbable that a mosquito herself would sometimes be gobbled up as she rested on the water, in the act of constructing her egg boats. As for the sun, he shone on the tub one hour every morning, which was sufficient for so confined and small a body of water. The morning sun is always best, the rays are not so direct and ardent.

The great mistake in nearly all aquaria is that there is too much exposure of the water to the action of light, by which the spores of minute vegetable organisms contained in the water are developed in immense quantities by the heat rays of sunlight, till the water assumes an opaque greenish color, which can be overcome only by darkening down the tanks, or introducing snails and other animals that feed on this vegetable growth.

This tub was like a pond with its bottom and sides—not like the ill-constructed aquaria of the present day, with light penetrating the water from top, sides and ends, blinding the fish and stimulating the plants, till they spindle away into floating masses of decay. Another advantage about this tub aquarium was, that it was constructed of wood—a non-conductor of heat. The majority of tanks now-a-days are constructed of iron and glass, which are excellent conductors of heat.

The conferva are plants of a low order known as cryptogams, because they do not produce flowers, and their fruit or seed-bearing organs are not easily discovered. Hence the term *cryptogam*, which literally means hidden or secret marriage. The spores are contained in all water except spring water, and are also frequently present in the atmosphere. It is slow of growth, seldom develops in a well-regulated tank till the second year, and requires from one to two hours' sunlight a day and low temperature of water. Goldfish, crayfish, suckers, caddis-worms, snails and some varieties of tadpoles will eat up the young growth as fast as it develops. None but purely carnivorous fish can be placed in the same tank without its being destroyed. Dealers do not have it on sale, nor do they cultivate it in their tanks, as they prefer plants of freer and more robust growth, that can be bunched.

This tub aquarium ran successfully for several months, till one day I overstocked it with animal life and thus unwittingly disturbed the balance of nature. The minnows died, the green was eaten up by snails, and I concluded that I had offended the fairies or they had moved away, which accounted for the death of all and every fish placed in the tub ever afterwards.

In course of time when I had gained a knowledge of the laws that govern aquaria, I established a more wonderful tub than this one, and of this I will tell in some future article.

A. W. ROBERTS.

Engraving on Wood. II.

BY SARAH E. FULLER.

IN retracing the outline so as to transfer the drawing from the paper to the block, the point should not be sharp enough to cut the tracing paper. Retrace carefully every line, and do not bear too hard or you will bruise the wood, but use pressure enough to make the marks of the soft pencil come off on the block. On removing the tracing paper, a delicate pencil drawing will be seen, sufficient of the soft pencil having adhered to the wood to make a distinct drawing. It is now necessary to use a hard pencil, the six H being most suitable. With this pencil go over every part of the outline on the wood, strengthening the weak lines, and correcting any slight irregularities that crept in while tracing and re-tracing. Sometimes a piece of tracing paper, one side of which has been rubbed with red lead, is laid with the red side next to the block, between the block and the tracing. On tracing over this, the delicate drawing made on the wood will be red, and then can be drawn over in the same manner as the lead pencil tracing. This method is convenient when there are many lines, and they are close together.

When the outline is completed, and it is desired to put in the shading, this may be done with the pencil if the shades are light, and made up of lines crossing each other, making what we technically call "fac-simile" work. But if the shades are in "tints," that is, made up of even or graduated lines, it is usual to "wash" in the tints with India ink—the light

tints being put in first, and the darker ones made by repeated washes. After the tints are finished, complete the design by retouching where needed with the hard pencil; put in a few lines to suggest the direction in which the lines of the tints are to be cut, but it is not necessary to put in every line to be cut, except in the class of engravings named above.

To illustrate what we have just told you, we want you to examine the accompanying engraving of a flower. The sketch of this being on paper, we will remind you to trace all the outlines, that is, the edges of the leaves, flowers and stems, the stamens and veins in the leaves, and notice how some of the petals are turned over. When you have traced the picture on the wood in the way we have just described, proceed to "wash" in the tints. You need a cake or stick of India ink. On a small plate or saucer, with a few drops of water, rub a little India ink, using your judgment about the amount you require. Add water to make the ink pale enough for the light tint on the petals. With your brush moderately wet, put in this tint, being careful to leave the white places. Wash over the leaves and stems in every part except where it is quite white. When this first wash is dry, put on a second one, in the darker parts, leaving the light untouched, and a third or fourth wash in the darkest of all. You need to be very careful in making these washes, that you do not rub out the lines you traced. And probably with your best care, it will be necessary to pencil many of them over after you have finished washing the tints in. When you have corrected all the pencil lines, your drawing is done. The numberless fine lines that represent the tints are cut with the engraving tools, which cut out the white places between the lines you see printed, and stopping whenever other lines cross them. We have now told you how to make the drawing on the wood. We will next tell you how to engrave the drawing you have made.

Precision in Weighing.—The balance is now so perfect that according to Herr Jolly, weights of 1 kilogramme ($2\frac{1}{5}$ lbs.) may be compared to within the one-thousandth of a milligramme, or .0000154 grain.

Drawing Lessons. II.

BY JOHN CLARK CENTER.

We hold that as a factor of Education in almost all the practical departments of Commerce, Science and Art, the power to delineate any object or idea, is indispensable. The Engineer, the Builder, the Mechanic, the

Merchant, the Scientist, etc., each in his department, depends upon it to facilitate his progress, or to publish to the world his inventions or wares. For by a well-executed illustration the mind can comprehend at a glance, what a volume of words could not express.

Who can acquire this power of Drawing? Every one in the degree of his mechanical ability, and by perseverance in overcoming a few apparent difficulties, which we will endeavor to carry the student over. A fair degree of skill may be attained by at least ninety out of every hundred.

Now what is Drawing?

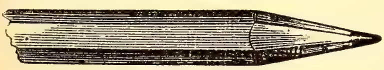
It is the method of combining straight and curved lines with proper adjustment of lights and shades, on a plane surface, so that any object or combination of objects may be repre-

sented; and thus we are enabled to reproduce to the eye and intelligence the form and general character of the subjects under consideration. The first step therefore must be to study the character of those lines and curves, lights and shades, which by acquired skill can produce such splendid results.

The development of this power involves the training and education of the eye, the mind and the hand, to act in unison. Systematic exercises for this purpose must therefore be carefully, faithfully and patiently persevered in, until this faculty be acquired. The judgment must also be able to approximate, independent of mechanical means, relative proportions, equal divisions of lines, perpendicular and horizontal relations; the nature and combination of peculiar curves, all of which by judicious handling, give the outlines of objects. These efforts may be tested by the rule, the compass and the square, to ascertain how near they come to the truth. But the *sine qua non* of success, is to acquire, as an instinct, independence and self-reliance.

To some this may appear difficult, and to many it may be really so, but perseverance will overcome, these difficulties will vanish, and the dawn of new power will richly repay and strengthen the aspirant.

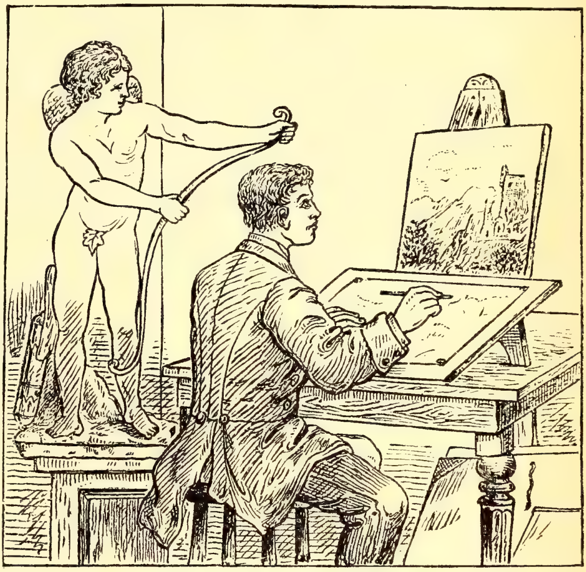
Provide yourself with a supply of paper for first exercise practice, get the cheapest you can find (unfinished brown is good); do not imply by this that your efforts are to be of a like cheap and common order; but *economy* in this matter will be the most useful lesson you can learn, for with many the desire to learn is frustrated by the extravagance of teachers, who require the very best and most expensive materials, which is not necessary in preliminary practice and study.



For *pencils* No. 2 Faber's are the best; these can always be depended on. To sharpen the pencil for exercises at this stage, do not get too sharp a point, as the nature of the work does not require it.

And now before we make a start, as we cannot superintend you in person, we must say a few words as to the best position for comfort and freedom of action. Many fail in not giving due importance to this point.

Procure a board say 24 by 18 inches, many of our readers can make one for themselves. Let it be smooth and square, place it on any ordinary table at an inclination of about 25°. This



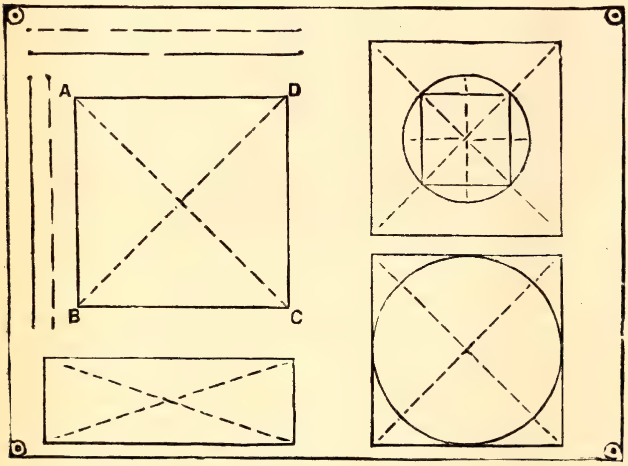
can easily be done by placing one or two books under one end of it.

Then place the body so that the greatest freedom can be maintained for the greatest length of time. We, in our usual work, can sit so, working on the most intricate and difficult drawings for ten hours a day, and every day at that, without any great fatigue. But we would not recommend beginners to sit more than one hour at a time, as the apparently dry exercise is liable to become wearisome, and induce carelessness. Carelessness must be avoided, in fact must have no part in any endeavor. Having secured your square sheet of paper on your board, be careful to place it so that it will be parallel with the four edges of the board; as this will be the only guide you will have to train the hand and eye in making perpendicular and horizontal lines. Take the pencil in the hand with a very free hold; do not draw from the wrist, but let the arm have an easy motion from the left to the right; avoid all stiffness. Now first let us practice on horizontal lines.

In the accompanying engraving we have endeavored to show all these points so that they will be easily understood.

Place by the eye on the upper left hand corner of your paper, two dots, say two inches apart (thus learn to judge measurement); and be careful that they are at equal distances from the upper edge of the paper. Then as a straight line is that which lies evenly between two points, join them from left to right by broken motions at first, as you will find this easier than in one continuous line. The perpendicular lines are to be treated in the same manner, they are to be drawn from the top downwards. The union of these two will give us a right angle.

By joining these two by an oblique line, we have a triangle A B C, and by carrying another line from A parallel to B C, of the same length to D, and then joining D C, we have a square; join D C and we have the diagonals of the square. This must be fully mastered, and you must be careful to test and try your work not only with the eye, but by measurements, as an error in this stage of a drawing would throw the whole drawing out of proportion. This you will see, is the key to any number of designs which may be contained in the square.



Again, by using the dotted lines as in the next example, the circle can be constructed in easy sections, and within the circle, all the possibilities of design which it may contain. We close this introductory lesson with an earnest appeal to our young readers to make themselves masters of these important exercises, not by merely drawing them once or twice, but making them part of themselves. In our next lesson we will show those who faithfully work out these exercises that they can do more than they imagine they can. For

> "By slow degrees to noble Art we rise,
> But lo! how grand to gain the glorious prize."

How to Make a Good Pantagraph.

BY WALTER W. SCOTT.

AMONG the instruments for reducing or enlarging drawings, the pantagraph, when accurately made, certainly takes the first place. Since the value of the pantagraph depends upon its accuracy and the absence of all lost motion at the joints, it is necessarily a costly instrument and seldom finds its way into the hands of the young, except in a very crude form. Now I will show how a very good instrument of this kind can be manufactured by any boy of intelligence, who has a little practice in the handling of carpenters' tools. By reference to the accompanying illustration it will be seen that the instrument consists of four parts, resembling rulers jointed together at their extremities, and two sliding carriages, having provision on their under sides for holding a pencil, while they are provided with clamping screws to hold them in their place.

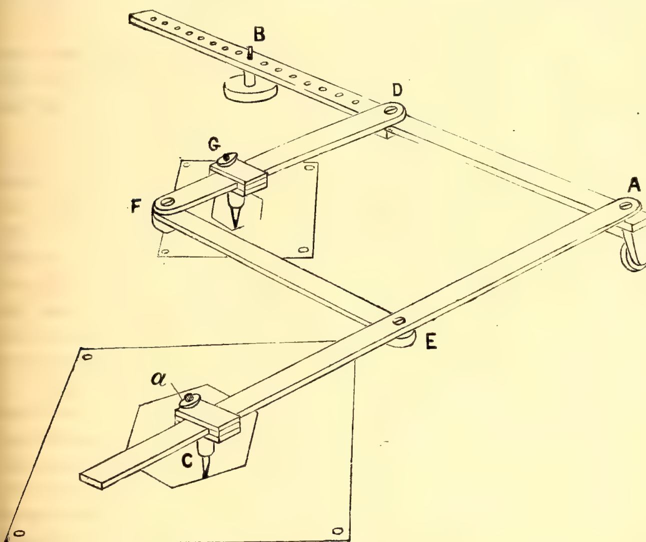
The pieces AB and AC are each two feet four inches long, from the centre of the screw at A, to the extreme end, one inch wide and one-quarter inch thick. The distances center to center AD, AE, FD, FE, are equal, being twelve and a half inches. All the joints of the instrument are made with one inch screws, and small blocks of hard wood, one inch by one inch, by half-inch thick, are glued under each joint to form a good hold for the points of the screws.

The fulcrum B is a leaden weight four inches diameter, and about one inch thick, having a wooden stem in it, so that it measures two and a quarter inches from the under side of the lead to the top of the wooden stem. A stout needle or short piece of wire, is driven into the top of the stem for the instrument to turn on. The holes in the piece AB at B, are about half an inch apart, and of such a size as to slip over the wire on the fulcrum easily.

The pencil used must be rather hard, say an

H, or No. 4, and must be nicely pointed on a file or piece of sand-paper.

The sliding carriages G and C are made of two pieces of black walnut, 2 in. × $1\frac{1}{4}$ in × $\frac{1}{8}$ in. thick, such as is used for scroll sawing, and two pieces $\frac{1}{2}$ in. × $\frac{1}{4}$ in. × $1\frac{1}{4}$ in. long; the small pieces are glued between the ends of the large pieces so as to make a block, with a hole 1 in. by $\frac{1}{4}$ in. (the size of the rulers), running through it. The pieces AC and DF must now be slightly reduced so as to slide easily, but not too freely, through the holes in the carriages. Two ordinary cotton spools with one end of each sawed off square, just where the bevel ends and the straight part, on which the cotton is wound,



commences. One of these spools must now be glued to the centre of one of the thin sides of each carriage, and the opposite side must be cut through one of the joints where it is glued to the $\frac{1}{2}$ in. × $\frac{1}{4}$ in. × $1\frac{1}{4}$ in. piece, with a thin saw, so that when that end is pinched together it will bind on the ruler, where before it slid easily. The clamping screw is made of a common 1 inch wood screw, inserted from the side on which the spool is glued, and the head countersunk, in the centre of the width of the carriage, and $\frac{1}{4}$ in. from the end, thus passing through the middle of the joint that was cut.

To prevent the screw from turning and also from dropping out, a small wire staple, similar to a double-pointed carpet tack, is driven across the head of the screw, so as to lie in the groove; and a nut is made from a piece of hard wood 1 in. long, $\frac{1}{2}$ in. wide and $\frac{3}{8}$ in. thick, cut to the shape of an oval and slightly rounded on the under side, so as to bind only on the bottom, as shown at A. In order to get a good, clean thread in the nut, a tap may be made by taking a common screw of the size you are using, and with a saw-file making three or four grooves lengthwise of the thread deepest at the point.

To reduce a drawing to one-half the original, set the instrument so that a hole at B, which is in line with the points of the pencils at C and G, is just as far from G as that point is from C. I always make the pencils fit tight in the spools by wrapping paper around them, but a screw may be inserted to hold them, but it is not necessary. In setting the instrument it is always necessary to have the pencils and the hole in which the fulcrum is placed, perfectly in line. For this purpose a piece of wood the size of an ordinary lead-pencil, about four inches long, with a knitting needle driven into the end, so as to be in line with its centre, is very useful, as by placing it in the carriage at C, and then sighting across the point of the pencil at G to the hole in B, they may be adjusted perfectly in line. The distance from B to C represents the original, from B to G the reduced copy; by varying either, any amount of reduction may be made.

Instead of two pencils a piece of hard wood the size of a pencil, sharpened to a point, may advantageously be used in C, when reducing and in G when enlarging.

At A, on the under side of the piece AB, and just beyond the block under the screw, is glued another block $2\frac{1}{8}$ in. long, of the form shown; and at its lower extremity is fastened by a screw, a small wheel, readily made out of a coat button, and projecting below the bottom of the block to which it is fastened, $\frac{1}{8}$th inch.

When passing from point to point of the original, and not wishing to make a mark on the copy, the pencil may be raised from the paper by raising the joint at F a sufficient amount.

Bust Modelling.

ADELAIDE F. SAMUELS.

NOW if you are fully satisfied with the profile, you can begin measuring for the front view. You have the height of the forehead already; you now want to find the distance across, from temple to temple, as shown in Fig. 5, then from the same point on the temple to the ear. Next measure from eye to eye, mark the clay to keep the measurement, then find the height of the nose, between the eyes, to the inside corners of the eyes, and work out the clay between the nose and the eyes, being careful not to disturb the profile. Next find the length of the eye, then the distance from the end of the eyes to the ears. Do not attempt to do any fine work about the eyes yet.

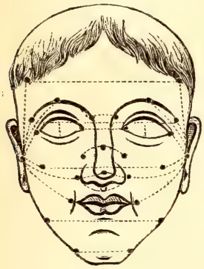


Fig. 5.

Now find the distance from the top of the eyebrow to the end of the nose, then from the top of the eyebrow to the ear, and work away the clay, of course, until you can get those measurements on it; and so on, until every measurement, as shown on Fig. 4 by the dots and dotted lines, has been taken and worked out: when you will have an image that will not be at all flattering to the sitter. It will resemble more a pagan's idol, but don't be discouraged: Rome was not built in a day, you know.

Now we must pay particular attention to each feature separately, beginning with the *Forehead.*

First be sure that you have not lost the profile, by comparing it well with the sitter's, then model the clay, very carefully, on both sides, with tool No. 1 until you have an exact copy of the sitter's forehead, as seen from every point; take extra measurements, if necessary, and if you should take off a little too much clay, you can add more by wetting a piece and rubbing it on with tool No. 2, so that it will not show. After you are quite sure the forehead is shaped as it should be, go over it with tool No. 2 several times, holding the tool firmly, and working it about in fine circles until the clay is as smooth as the sitter's skin.

The next to take all your attention will be the *Eyes.* Perhaps no part in bust-modelling is more difficult than getting the two eyes exactly alike, and also exactly like the sitter's. The great trouble with new beginners, is, they invariably model them *flat,* like a cat's eyes, when they should be more like Fig. 6. If you look well at the sitter's eyes you will see that the outside corners set back farther into the head than the corners near the nose; also the lower part is farther in than the top.

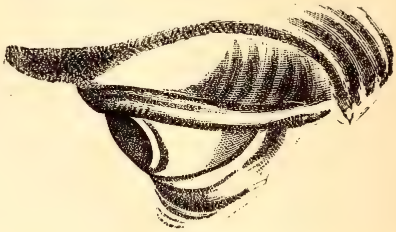


Fig. 6.

Some sculptors model the eyes plain, while others mark the colored part by sinking it in. As all the old masters made them plain, we can afford to.

Model the lids distinctly, perhaps a trifle thicker than the sitter's, for effect. Omit the lashes, of course, and the eyebrows, also, unless they are very thick and shaggy on the sitter, then they are to be added after the face is finished, in the same manner the hair is.

The next to claim attention is the *Nose.* You have only to model it as near the sitter's as possible. Take as many measurements as you like, do not lose the profile, and be sure before it is done, that there are no sharp corners or edges about the nostrils. All must be rounded and smoothed to perfection.

Next comes the *Mouth.* You will find it difficult to get the corners just right. You must look at the sitter's mouth from every point of view, and copy it in the clay, always being careful not to disturb the profile. After you have all the *curves* and *angles,* you can make the *color-line,* which is done, not by making a *distinct line,* but by working the clay, where the lips are red, one way with your tool, while all around it is worked another way.

The *Chin* and *Cheeks* must each be measured and copied, and nicely finished.

The *Ears* must be measured from the outside rims with the calipers, then one at a time must be modelled, measuring every way with the dividers as you go along. There is much satisfaction in modelling the ear, it can be made to resemble life so closely. You can use

your finger to advantage in smoothing it off, after you have got it the correct shape.

Next take all the measurements of the *Skull,* without regarding the hair, and work away the clay for them, so that your bust will appear "bald-headed all over." Take the measurements for the neck also, but you need not finish it off nicely until you are done with the next in order, which is the *Hair.*

Wet some of the pieces of clay and work them together until they form a mass that is *almost* thin enough to run through your fingers; take some of this in your hand, and throw it carelessly upon the skull, twirling and twisting it with the fingers until it takes the form of the sitter's hair; repeat the operation of adding, twirling and twisting the soft clay upon the bust until it has as fine a head of hair as the sitter has. Do only half the head at a time, that you may keep the parting clean, and be careful to have it come just as it should over the forehead. The *quicker* and *more carelessly* the hair is "thrown on," the better it will look, if it is done gracefully. It must not be touched again until the wet clay is as dry as the other, then with the small end of tool No. 4, go over it lightly, letting the tool always take the same course the hair takes.

Next come the *Neck* and *Shoulders,* which must be measured and modelled as near like the sitter's as possible, then nicely finished.

In order to make the *Drapery,* if the bust is to be draped, you must manufacture something that resembles a neck and shoulders, to throw the cloth over for a model. A piece of cloth, cut and sewed, so that it would fit over the sitter's shoulders and neck, then stuffed with straw or cotton, while a lath, nailed to a bench, as in Fig. 6 run up through the centre of it to keep it in position, would answer the purpose.

Throw the cloth you intend to copy, in graceful folds over that, and do not let the position get disturbed after you have it adjusted to suit you.

Some artists *dampen* the cloth before arranging it; they say it makes better folds when damp, and remains in place better; while others say the folds when damp, are not *natural.*

Do not try to *make* the folds in the cloth unless you want them to appear *stiff:* throw it carelessly over the shoulders, and let it take its own position; if you do not like it, throw it again and again, until you are suited.

Now take strips of clay as nearly the size of the folds as possible, and place them over the shoulders of your bust, until you have as many on it, and in the same position, as in the cloth model. After you have them all roughly reproduced, go over them with tool No. 1, and copy the cloth as closely as you can. Unless

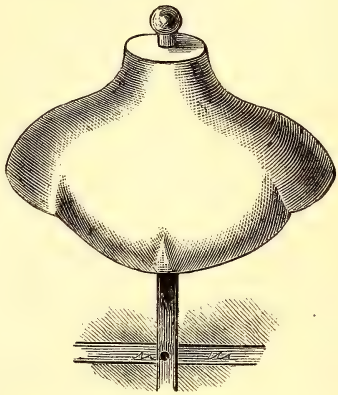


Fig. 7.

you are careful to note all the rises and depressions, and reproduce them in the clay, your drapery will not be a success.

After that you can spend as much time as you want to, doing "nice work," or putting on the finishing touches. Compare the face once again with that of the sitter, to see if the likeness cannot be improved, and when you are perfectly satisfied with it, if you *ever can be that,* you can make your preparations for *Casting the Bust in Plaster.*

To be continued.

Lessons in Magic. IV.

HOW shall we have the particular card drawn from the pack, which we wish to have, arise? That is what I promised, in my last article, to explain, and that promise I shall now try to fulfill.

The best way to do this is by all odds by *forcing,* but as that requires more practice than most amateur magicians care to devote to it, we shall describe another, but more clumsy method. This is by means of what is known as a *forcing pack.* It is a pack made up of six or seven kinds only, say eight of the ten of clubs, eight of the Jack of spades, eight of the three of hearts, eight, seven of diamonds, eight queen of spades, and eight deuce of diamonds. Of these cards all of a kind are gathered to

gether, and then are placed on top of each other, forming apparently an ordinary pack.

Armed with a pack of this kind, the magician goes into his audience, and approaching some lady or gentleman, begs that a card may be drawn. As the person puts out his hand to take the card, the performer runs off the first eight for him to select from, keeping the others in one solid mass. To the next person he runs out the second eight, and so on until six cards are selected. Of course in each instance all but the cards from which one is to be selected, are kept together in a solid mass, and there is no temptation to any person to draw one of them.

It is, as I have said, a very clumsy method of doing the trick, and not to be compared to legitimate *forcing*. Before I can explain this, it will be necessary to explain the first great principle of card manipulation, known as *making the pass.*

Making the pass consists in passing one or more cards from the bottom to the top of the pack, or *vice versa*. By this means the conjuror not only knows where certain cards are to be found, but has them completely under his control, and can, in a second, change the position of a card from the place in the pack where the audience have just seen it, to such place as may best suit him.

To perform this most important piece of legerdemain, hold the pack in the left hand, and spread it open with the right so that a card can be taken from it. The card having been drawn, separate the pack into two parts, and extending the part which is in the left hand, request the person who drew the card to place it on top of that packet; this being done, put the packet which is in the right hand upon the top of the left hand packet, letting the third finger of the left hand come between the two. This will make an opening between the packets, but being at the end which is towards the performer, and the other end appearing closed, the presence of the third finger will not be suspected.

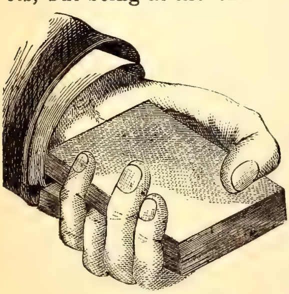


Fig. 3.

The pack is now in the position shown in this cut; next, with the thumb and the two middle fingers of the right hand, seize the two ends of the *lower packet* so that the pack is now held, as represented in Fig. 4.

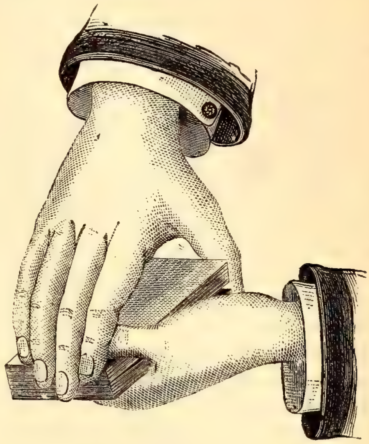


Fig. 4.

Everything is now in order to *make the pass,* which is done as follows: the right hand presses one side of the *lower packet* into the fork formed by the forefinger and thumb of the left hand, and holds it there, while the fingers of the left hand which hold the *upper packet* are drawn back as if to open the hand, the right hand being slightly arched to allow of this; the lower packet is then raised by the right hand, until the edges of the two packets meeting, form an angle as in Fig. 5.

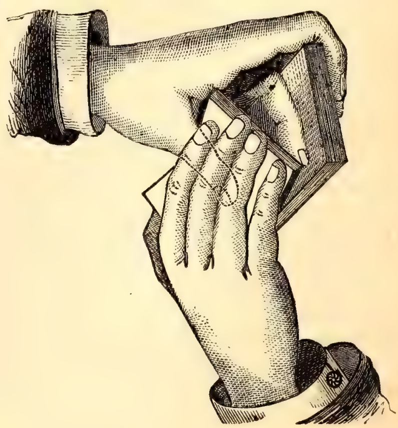


Fig. 5.

The fingers of the left hand are now closed, and the upper packet in this way laid on the palm, while the lower one is placed on top of it, the position of the two being thus reversed.

These movements must of course be practiced until they can be made with the rapidity of thought, but even when this proficiency is attained, it is not well to attempt *making the pass* immediately after the card is replaced in the pack, for at that moment the eyes of the spectators are fixed on the hands of the performer, and no matter how rapid his manipulations may be, there is always more or less of a shock or tremor caused by the cards pressing against one another, and this being noticed, may give rise to a suspicion that by some means or another the card has been changed. It is better, rather, to wait until their attention has been called off, and then *make the pass.*

Having become dexterous in making the pass, you may now attempt *forcing.*

The card to be forced, being, we will suppose, either on the top or at the bottom of the pack, *make the pass,* and so bring it to the centre. Place that which is now the upper pack,

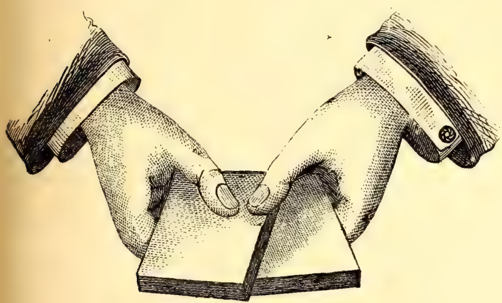


Fig. 6.

on the lower one, in a diagonal manner, as in the illustration, so that the two packs look something like a fan when half way opened.

Suppose that the pack is in the right hand, the top packet will be under the control of the left hand.

Spread out the cards of this packet with the fingers of the left hand, and the thumb of the right, always remembering to keep in sight the card, to be forced; if this card was on top of the pack before *the pass* was made, it will now be the first one of the lower packet, and if the under one of the pack, will be at the bottom of the upper packet.

Present the pack to some person, with the request that he or she, (and I must here remark that it is much easier to force a card on a lady than on a gentleman) will draw a card, "which ever one you like." At the moment that his hand reaches the pack, quietly slide along the cards of the top packet, by means of the right thumb, until just as he is about to draw, when you must so manage that *the card* will be invitingly before him. By thus sliding along the cards, you at once do away with the idea that there is any preparation about the matter, at the same time that you are, by this means, enabled to reach the card you want to force and which in ninety-nine times out of a hundred, will be drawn.

It requires some little practice, but as it is almost indispensable in magic, the time spent in perfecting yourself in manipulation will not be lost.

The Heavens for February.

DOUBLE STARS.

Under this head we will give each month some tests for telescopes of different grade.

a Ursæ Minoris (Polaris) is a fine double. The companion is faint and difficult to "pick up" with a small telescope. An aperture of two inches and a power of sixty will separate them. The companion is estimated to be of the $9\frac{1}{2}$ mag. and $18''.6$ distant from Polaris, having a pale white tint. Rev. W. R. Dawes saw it with his large refractor, having its object glass diminished to one inch and using a power of eighty, but no small instrument having an object glass less than two inches will show it. After once finding it with a large glass it is much easier to catch it in small ones. A power of thirty-five or forty will show about thirty stars in the field with Polaris. Proctor mentions this as a good test for the illuminating power of telescopes.

METEORIC SHOWERS.

Some years ago a committee was appointed by the British Association for the Advancement of Science, to systemize and analyze all the facts and reports concerning luminous meteors. The epochs which this committee established we will give each month. For Feb. they are: 10th, 15th, 18th, March 6th and 12th. These are simply the dates on which star-showers have occurred with more or less frequency, and for those interested in meteoric astronomy a fine field for investigation is presented to establish their periods and radiant points.

These two lines that look so solemn
Were put in here to fill this column.

THE

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Postage free to all parts of the United States and Canada, except New York City. Our absurd postal laws make the charge for delivering our journal to subscribers in New York city five times as great as that required for transporting it across the continent, and delivering it to subscribers in San Francisco or New Orleans. We are therefore compelled to charge our New York subscribers the 12 cents postage which we have to pay on city addresses.

Care of the Microscope.

THERE is scarcely any instrument that is more easily injured by rough usage than the microscope, and there is none that is more durable, provided proper care be taken of it; and as microscopes are as frequently injured from want of knowledge as from want of attention, a few hints may not be out of place.

The great enemy of the microscopist, both in regard to the preparations on which he spends so much labor and the instrument which he uses for examining them, is dust. To the microscope itself, dust is utterly destructive. It not only dims the glasses and makes specks on them which appear to be part of the object, and thus cause errors, but it gets into the working parts, grinds them and wears them out rapidly, destroys the accuracy and evenness with which they move, and clogs them so that great force is needed where force should not be applied. Often and often we have seen microscopes sent to the maker for *repairs*, which only needed *cleaning*.

The first thing then is to exclude dust. The microscope should never be exposed except when it is in use, and then it should be kept from all extra invasions of dust. When not in use it should be kept in its case, and as the taking out and putting back of the instrument is always more or less of a bother, the case should be made to receive it without any necessity for its being unscrewed or taken apart except in the case of travelling microscopes or seaside microscopes, where great compactness and portability are desired. Hence the upright case should always be chosen, and it should be large enough to take in the microscope with its eye-piece attached. If it gives much trouble to take the microscope out of its case, the instrument will often lie unused when great advantage might be derived from employing it, and this not on account of the laziness of the owner, but simply because he has not time. When it takes ten minutes to get the microscope ready and five minutes to examine the object, the examination will not be made if we have only ten minutes at our disposal.

The case, of whatever shape, should close tightly, and if kept in a region where the dust is plentiful and of a very grinding character, a thick covering of some close material, like oil-cloth or leather, should be thrown over it. It should be so loose that it shall be but a moment's work to take it off or put it on, and it is best made in the form of a case or bag, the edges of which are firmly sewed together. Ordinary porous cloth allows dust to pass, and will not answer.

When, in spite of all precautions, the microscope has been soiled, it should be carefully cleaned, and for this we will give directions in our next issue.

Examination of Powders.—A New Employment for the Microscope.

The value of many materials that are used in the arts depends very much upon the degree of fineness to which they are reduced to powder. This is usually judged by the sense of feeling—a little of the powder being rubbed between the fingers. In some cases the appearance of the powder as to color and its behavior when laid in a little heap, and moved about with a knife or spatula, is a good guide. Most substances, when reduced to very fine powder, behave like fluids in some respects and like solids in others. For example, they can be made into a heap with a perpendicular face, which cannot be done with sand for example. (Try this with flour or with silica—sand very finely powdered). But the most accurate way of judging of the fineness of powders is by the microscope. Under a power of 100 diameters, most powders look coarse; 250 shows well some powders which

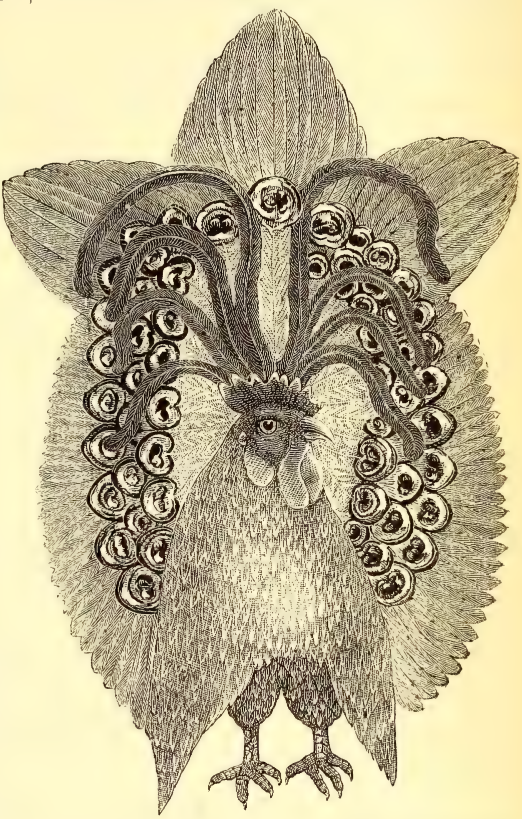
are regarded as very fine, while there are no powders in market which do not appear coarse under a power of 500 or 600. The methods of examination will probably vary under different circumstances, but in any case, the operation is a very simple one.

In this case a doubling of the magnifying power more than doubles the efficiency of the microscope, for this is one of the few cases where areas and even cubical contents are of account. A fragment seen under a power of 100, will appear as large as a fragment that is not only 10,000 times, but 1,000,000 times as large, and under a power of 600 diameters, a fragment weighing the 1-10,000th part of a grain would appear as large as one which weighed over three pounds avoirdupois! This seems very astonishing, but a little calculation will readily show its accuracy and points very strongly to a hitherto neglected but very important employment for the microscope.

Fire Screen, Lambrequin Ornaments, etc., of Cock's Head and Plumage.

Boys, and girls too, should learn the easy, and interesting art of Taxidermy, by which they may not only preserve and mount the various pets they are so unfortunate as to lose, but may also with very ordinary fowls, birds and animals of various kinds, make elegant household ornaments and embellishments; perhaps establish a cabinet-case, in which, on a tree they will have various birds, while on a rock a fawn will stand as naturally as if in its forest home; and rabbits, squirrels, "'coons," etc., peep out from different coverts, or lie upon the grass; stoop to drink from a tiny lake, or reach up to the foliage of the tree above them; while the faithful dog you loved so well, appears to guard the mimic forest, and the several pussies you have lost, look as natural as in life, upon the roof of the cottage, arranged in the corner. This is by no means an impossible attempt, and we could describe three such pretty museums, one of which is arranged in the recess of a sitting-room, and is a source of constant delight. It is inclosed with glass doors, and is a pretty bit of nature. But a very simple first lesson is the one I am about to describe to you now, as a means of making a pretty ornament. I will suppose you have a handsome specimen of a chanticleer in the yard which you will kill in a humane way, by cutting a blood vessel in the neck, which is easier than wringing or chopping it, and will not spoil the beautiful feathers; now when dead, place it on its back on a piece of clean board, and having provided yourself with a sharp pen-knife, a pair of cutting plyers, a pair of strong scissors, of medium size, a button-hook, a salt spoon, and a hand vise, a needle and some linen thread, (a hone on which to touch your knife occasionally); annealed wire (you can make it red hot, and leave it in the air until cold, which will anneal it very well); some hemp, raw cotton (wadding), whitening, pulverized alum or chloride of lime and arsenic or arsenical soap, a brad-awl or two, some pieces of old soft rag, and a wet towel on which to wipe the fingers.

Spring is the best time for preparing wild birds, but our cock may be taken when convenient. Keep



the bird for three days—if the weather will permit, as the skin will then separate easily.

Lay the bird on its back, part the feathers along the breast where an open seam appears, extending round the lower part of the neck; cut around this and separate the body from the neck, carefully, then turn the skin over the head; the back of the skull will now appear, cut a small hole in this in semi-circular form, turning it up like a trap door, and into it pass the little spoon, scooping out all the brains, etc., then with a small half ounce syringe, squirt water gently in and wash out the cavity, into which dust the alum and arsenic mixed, and fill with wadding.

The next step requires care—namely, the eyes; cut carefully round with the sharp knife, pressing the orbit gently to aid in crushing the small bones, separating the ball from the roof of the mouth, then catching the ball with small forceps, you can draw it

out from the socket, wash, and dust with the alum mixture, then fill with cotton.

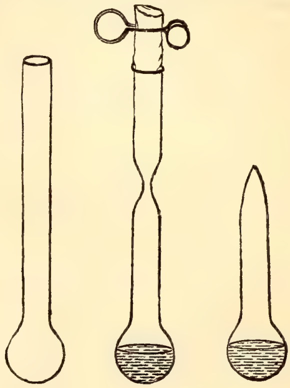
Next, wash the neck carefully, and cover with the powder; then make a frame of wire which must consist of a large circle—of size of the large end of the neck, and a very small one fitting in the narrow part next the head, uniting them with four straight pieces, that will keep the neck extended; then cover with muslin wound round each wire, and putting the frame in the open skin, fill the whole cavity with tow or cotton. Next put in the eyes, consisting of beads or, far prettier, the regular glass eyes sold by taxidermists and fancy stock dealers. If not too large, these are easily inserted after removing the ball of cotton, and the juices from the lid will form a cement that will hold them. Thus mounted, your head will dry out without any trouble, but if the weather is warm, use corrosive sublimate, instead of alum and arsenic.

Next cut a piece of pasteboard fifteen inches long (more or less), which cover neatly with colored muslin. Around the edge sew a border of handsome peacock's or cock-tail feathers, and a row of each is very beautiful, then place the cock's head in place, and in the centre of the back arrange several graceful waving plumes. By lifting the outer row of feathers, the stitches are easily inserted.

Wash the feet very clean, rub the raw end with the alum and arsenic, score the under part of each claw and rub in all the arsenic and alum possible, then sew up the skin; varnish (when quite dry) with dammar, and fasten as shown in the illustration.

The Water Hammer.

This is a very curious little piece of apparatus, which any boy can easily make for himself. Take a piece of glass tubing with pretty thick sides; the bore should be about one-fourth of an inch, and the outside diameter about three-eighths of an inch. Heat the end strongly in a spirit lamp or Bunsen burner. The latter will answer without a blow-pipe and even a good spirit lamp with an organd or circular wick will answer. The end of the tube being soft, draw it away, and the glass will gradually close. It must now be thickened by heating it strongly in the flame, rotating it constantly, and pressing the glass carefully up with a piece of metal. When the glass is thick enough, bring it to a bright cherry red, remove it from the flame and blow into it, rotating it all the while. It will soon look like A. Now heat it about six inches from the ball, and draw it out as shown in B, until the bore is not larger than a pin. Cool it very gradually, and when quite cold fill it two-thirds full of water. If you have some rubber tubing and a spring clip as shown at B, they are the most convenient for the next step. But a good sound cork will answer. Or if you have the rubber tube and no clip, put on the rubber, and in it put a piece of glass or metal rod about one-sixteenth of an inch less in diameter than the bore of the tube. Now grasp the tube, just below the rubber tube, with a common wooden spring clothespin, and hold it over a small spirit lamp until one-third of the water has boiled away in steam—passing out between the rubber tubing and the glass or metal rod. Let an assistant now tie a fine but strong cord firmly around the rubber tube, and it will be pressed against the inner rod so that it will be closed air tight, and remember that at the very instant that the cord is drawn tight, the lamp must be removed or more steam will be made, and you may have a boiler explosion on a small scale. By applying a sharp jet of flame to the



The Water Hammer.

thin part of the tube it may now be sealed up air tight, or *hermetically* as it is called, and the water hammer is finished, looking like C, but not quite so dumpy.

If you have done everything properly, the tube and ball will now be empty of every thing except a little watery vapor—all the air having been driven out by the steam from the boiling water. If the bulb is shaken, the water meets with no resistance in its movements and makes no froth or bubbles. But the strange point is that when the water is thrown quickly from one end to the other, it strikes the glass like a hammer, and gives a sharp metallic ring. Hence the name. Under ordinary circumstances, when water is driven against a hard body, the air forms a cushion, and a slushing sound is heard. Here however, the cushion is absent, and the water comes at once in contact with the glass, in which it produces the same vibrations that a solid body would make. These vibrations pass from the glass to the air outside, and thence to our ears.

A Seasonable Experiment.

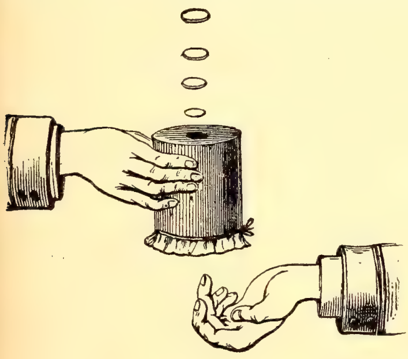
It has been found that the temperature at which water freezes depends upon the pressure to which it is subjected, and a block of ordinary ice, if subjected to sufficient pressure, might be entirely melted. The following very striking experiment which illus-

trates this fact, requires no special apparatus and is easily performed. Lay a block of ice across the back of two chairs, and over it pass a piece of fine iron wire the ends of which have been twisted together. From the wire suspend as great a weight as the wire and chairs will support, say 50 to 100 lbs. It is evident that since the extent of ice surface on which a fine wire will press is small, the pressure *per square inch* on the ice must be very great. The consequence is that just beneath the wire the ice is melted, and the wire drops down a little. As soon as the wire falls however, the water above it is relieved from pressure and immediately freezes. In a short time therefore, the wire passes completely through the ice, and allows the weight to fall, while the ice is not broken, nor is any mark visible where the wire has passed through.

Smoke Rings.

One of the most beautiful, though perhaps not one of the most brilliant experiments in chemistry, is the formation of smoke rings by phosphoretted hydrogen. In a still room, dimly lighted and with a small audience, the bright, but short-lived flashes of light and the self luminous rings of smoke, gradually widening as they ascend, and forming a series, nearly extending to the ceiling, are beautiful beyond description.

Unfortunately however, phosphorus is not a very safe article to handle, and unless in careful and skilful hands, the preparation of phosphoretted hydrogen is apt to give rise to ugly accidents. The following experiment is without danger, and is very interesting and beautiful: Take an ordinary can, such as is used for tomatoes, etc., and in the bottom punch a clean hole, about one-third of an inch in diameter; over the open end stretch a sheet of paper. This is best done by wetting some rough manilla or drawing paper, stretching it over the mouth of the can, and tying it down as in the figure. When dry, it will be perfectly smooth and tight like a drum. Throw a little smouldering brown paper into the can and it will soon fill it with smoke. If after a few seconds the can be held in one hand, and tapped with the other, very perfect rings will issue with a speed proportionate to the strength of the tap. These smoke rings deserve careful study, and we will return to them again.



Smoke Rings.

Varnish for Paintings.—" A good varnish can be made as follows: Mastic, six ounces; pure turpentine, one half ounce; camphor, two drachms; spirits of turpentine, nineteen ounces; add first the camphor to the turpentine. The mixture is made in a water-bath, and when the solution is effected, add the mastic and the spirits of turpentine near the end of the operation, then filter through a cotton cloth. The varnish should be laid on very carefully.

Steel Rust.—According to the *Chemiker Zeitung*, articles of steel which have become rusty may be cleansed by brushing with a paste made up of thirty parts cyanide of potassium, thirty parts curd soap, sixty parts of precipitated chalk, and a sufficiency of water. Great care is required in preparing and using this poisonous mixture.

The Camphor Barometer.—This toy, for it is little else, has been extensively sold as a reliable weather indicator. It was carefully examined years ago, however, and its indications were not found to be of any value. The reason of this is that the cloud which constitutes the "indicator" is formed either by pressure or by heat. Moreover the ingredients are apt to change with time and exposure, and this forms another element of uncertainty. The recipe as generally given is as follows: Dissolve two parts of gum camphor, one part of saltpetre, and one of sal ammoniac in 100 parts of 95 per cent alcohol, and add enough distilled water to precipitate a small portion of the camphor. Place this in a large glass tube with the upper end drawn out, so as to leave an opening not larger than a pin hole, or the end o the tube may be closed with a good sound cork. The instrument is to be fixed in the open air, out of direct sunlight.

Benzine and Benzol.—These two names are often confounded with each other. The first is usually applied to the product from petroleum, and the second to that from coal tar. They differ considerably in their properties, and as benzol is extensively used in microscopy, etc., disappointment has frequently been occasioned to those who have used benzine instead. Hager remarks that petroleum benzine, on dissolving iodine, assumes a *raspberry red* color, while coal-tar benzine becomes *violet*. Asphaltum is soluble in coal-tar benzine and insoluble in petroleum benzine.

Exchanges.

Yearly subscribers to the YOUNG SCIENTIST have the privilege of inserting three exchanges (or one exchange three times) during the year. This privilege is strictly confined to *exchanges; buying and selling* must be carried on in the advertising columns, where the charge is 30 cents per line. Each exchange is limited to thirty words, making about four lines, and in order to receive attention must be written on a slip of paper by itself. We file all letters received and have no time for copying out exchanges and queries.

As we desire to make the journal of the utmost value to *all* and not merely to serve the interests of individuals, we shall strictly adhere to these rules, which are certainly liberal, giving as they do advertising to the value of $3.60 free to each subscriber.

A combination scroll saw and lathe, cost $16.00, to exchange for a printing press or type. C. H. Parker, Coldbrook Springs, Worcester Co., Mass.

A bill boka board, in perfect condition, cues and balls, cost $8 very recently, in exchange for a scroll saw in good condition. S. F. Allen, 47 W. 12th st., city.

Scientific American, 1870 to 1878, over 450 Nos., not bound, to exchange for good Natural History, opera glass, watch, gun, or offers. J. T. Bell, Franklin, Pa.

Groff's Model Suburban Architecture wanted in exchange for Nicoll's Railway Building, Templeton's Practical Examination of Steam and Steam Engine, and Colburn's Locomotive Engine. All entirely new. F. H. Jackson, Angelica, N. Y.

Wanted, a small turning lathe, state what is wanted in exchange. Ralph A. Pillsbury, P. O. box 555, Belfast, Me.

To exchange, beautiful rose, milk, greasy and smoky quartz, graphic granite, orthoclase, etc., for aboriginal relics, coins, or other minerals. Prof. C. L. R. Wheeler, Bedford, N. Y.

A collection of invertebrate fossils, accurately labeled and worth $225, to exchange for good microscope. The instrument must be of modern make, and in first-class condition. S. Calvin, Iowa City, Iowa.

A collection of foreign and dept. stamps, or a large collection of bird eggs of the Southern States, for a set of drawing instruments or books on plain and ornamental penmanship. Address Q. R. S., Mt. Pleasant, Washington, D. C.

Wanted almost anything in exchange for a complete set of cabinet maker's tools. The chest alone is worth twenty-five dollars. Address Mr. Clark, P. O. box 37, Brooklyn, N. Y.

For exchange, two good dial telegraph instruments, and two good Morse telegraph instruments, for printing press or bracket saw. James Scott, 20 Patchen ave, Brooklyn.

A card printer, type and cards worth $1.50, and the book "His own Master" will exchange separately or all together, books, or offers. Geo. R. Simpson, Janesville, Iowa.

A stationary cylinder steam engine, or hardware goods in exchange for an electric call bell. L. J. Otis, 973 Prairie Ave., Chicago, Ill.

Wanted for a good Gundlach No. 4 (¼) Objective, a 1½ or 2 inch Objective of wide angle. C. Onderdonk, Brooksburg box, Madison, Ind.

A spy glass costing five dollars, to exchange for a companion scroll saw and turning lathe in good condition. John Buck, Brazil, Clay Co. Ind.

Forty good photo-lantern slides, plain and colored, for a good printing press and outfit; or a small screw cutting lathe; or first class microscopic objectives, or offers. Wm. R. Brooks, Phelps, N. Y.

Wanted, a small rifle, in good order, bore 22-100, for a telegraphic key and sounder, instruments are made of brass finely wrought, mounted on a japaned iron base. Louis E. P. Smith, 6 Alpine st, Boston, Mass.

Ferns, mounted or unmounted, for Northern species of same. List of those on hand and those wanted sent on application. Maj. R. H. Wildberger, Ky. Mil. Inst., Farmdale, Ky.

Two good business lots, central, in Ellsworth, Kan, for good microscope, accessories and books, chemical balance, or gold watch. Wm. Zimmerman, 114 Dearborn st, Chicago, Ill.

To exchange, a collection of 500 rare stamps, with book which cost $1.50. The whole worth about $7.00. State offers. Albert N. Webster, 106 South Park ave, Chicago, Ill.

Hinkley knitting machine, worth $40, for a watch or breach loading shot gun, Harry Holden, Black Earth, Dane Co. Wisconsin.

One dozen (assorted) mounted objects for microscope, cost $2.50 (By J. W. Queen & Co.) for useful books on any subjects, or old U. S. coins. W. M. Stribling, P. O. box 350, Circleville, Pickaway Co, Ohio.

Cabinet mineral specimens, for Masonic publications, or other instructive books. Light reading not wanted. J. P. Clough, Junction P. O., Lemhi Co. Idaho.

Swiss watch lathe, brass, steel shaft and box, cost $25. Also a gear cutting lathe nearly complete. Exchange for minerals, microscopic slides and books. H. A. Cutting, Lunenburg, Vt.

Twelve dollars worth of parlor tricks, very best make, in exchange for a good microscope or a scroll saw with lathe attachment, of equal value. Prof. C. H. Houghton, Middleboro, Mass.

Book on magic, cost $2.50, for back numbers Young Scientist, and foreign stamps. Omega, Post Warrensburg, Mo.

Wanted, Parrishes Pharmacy and chemicals. State what is wanted in exchange. C. O. K., 1520 Fairmount Ave, Phila.

Stereoscopic views of New York city and vicinity, in exchange for fossils from the Western states and territories. T. P. Wendover, P. O. box 1862. N. Y. city.

Chemical apparatus or balance, spy glass or saw wanted, in exchange for novelty printing press, with sixty fonts of type. Alex, 151 East 33d st, N. Y.

Microscope worth $7.00, and cabinet with forty good slides; for better instruction or other educational apparatus. Particulars on application. Arthur Hobart, Penn Yan, N. Y.

Wanted a copy of Bourne's Treatise on the Steam Engine, for a full set (7 vols. bound) of Technologist, cost $19.25. W. J. Allen, 256 Twenty-second st, Bkyn.

Wanted, a three wheel "velocipede" large size, state what is wanted in exchange. Peter J. Murray, box 743 Wilkesbarre, Pa.

To exchange, one Bunsen and two Smee batteries; for books on electro-metallurgy or quantative or qualitative analysis. A. W. Palmer, care of Watch Co. Springfield, Ill.

A pistol in good order, cost $3.00, in exchange for an electric bell. A. W. Honywill, 217 Cabot st, Boston, Mass.

Collection of over 500 rare stamps, including Ecuador Cape of Good Hope, Barbadoes, Honduras, etc., in exchange for microscope, minerals, or scientific publications. Jas. G. Kitchell, 345 Race st, Cincinnati.

Music box, printing press, cost $35, and complete outfit for cutting stencil plate for marking clothing, cost $25, for boiler large enough for ¼ horse power. Geo A. Battles, Westminster, Mass.

Three-quarter portrait camera tube, with box and tablets all new; for books on science, medicine, history, or travel, or microscopic slides. J. S. Mason, Medina, Ohio.

Wanted, a printing press or set of draughting instruments for a C cornet (worth $30.00) or Queen's Universal Household Microscope and accessories. G. E. T., Box 475, Westboro, Mass.

Fig. 3.

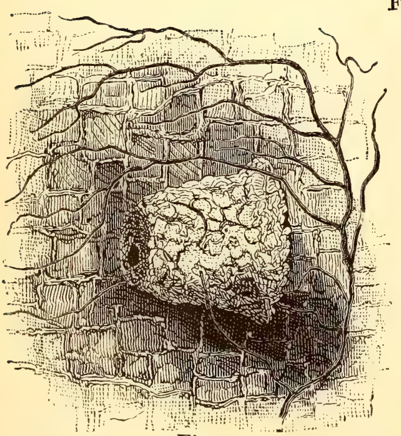


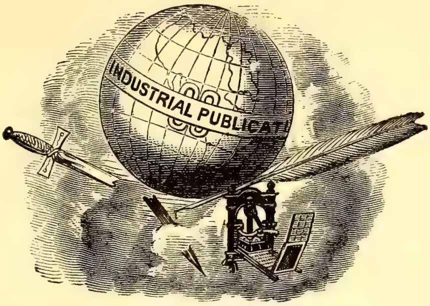
Fig. 1.

Fig. 2.

BIRD HOMES.

The Young Scientist

SCIENCE IS KNOWLEDGE.



KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL FOR AMATEURS.

VOL. II. NEW YORK, MARCH, 1879. No. 3.

Bird Homes.

BY A. W. ROBERTS.

BLUE BIRDS, martens, wrens, and the European sparrow, will all occupy houses built for them, seeming to prefer to be near our homes and to court our protection.

When traveling along our eastern coast line, from New York to Maine, I found the European sparrow everywhere, even at Grand Menan; and I was much amused at the many crude and comical styles of bird houses in use. Milk cans, butter firkins, old straw hats and discarded beehives were utilized for this purpose, and in one case a farmer had scooped out several hook-necked squash and club gourds which he had fastened under the eaves of his barn, for some wrens, who had taken possession of them.

I found the prevailing school of bird house architecture to be of this style (Fig. 4)—very primitive and very ugly. And as if to add to their ugliness, they were often painted of either a dead white, ultramarine blue, bright green or yellow, and occasionally bright red, and even black.

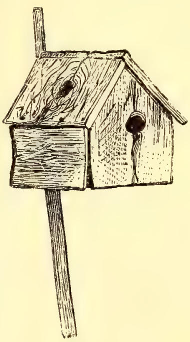


Fig. 4.

None of our native birds would be guilty of ever taking up quarters in a vermilion colored house, but those feathered tramps and loafers, the sparrows, ever ready to crawl into any hole or place to secure a footing, in this instance seemed color blind or indifferent so long as they obtained a roof to shelter them.

In painting bird houses, never use bright or glaring colors or gilding, as it is not only in bad taste, and not in harmony with nature, but to birds of modest and retiring habits is very displeasing. Imagine a pair of our plaintive-voiced blue birds dwelling in a bright yellow house! think of their rich blue against a vulgar yellow! Could any combination of colors be more inharmonious and displeasing to an educated eye?

All that birds require is a quiet and secure situation for their homes. My father some years ago fastened a number of flower pots against the side of a brick house. The holes at the bottom of the pots were made large enough for wrens, and too small for blue birds. As a battle had been raging for a number of days between the wrens and a pair of blue birds over the possession of the only bird house on the grounds, the flower pots pleased the wrens, who took immediate possession, and ceased their warfare on their neighbors.

I have since used flower pots extensively in constructing bird houses, and will try to give the readers of the YOUNG SCIENTIST my experience as a bird house builder.

Fig. 1 shows a seven-inch pot fastened against a stone wall; a hole is cut out of the bottom of the pot large enough to admit of either wrens or sparrows. For cutting the hole I use the large blade of a jack-knife, well notched, and soften the ware thoroughly with water. This reduces friction, and prevents clogging, or drawing the temper of the blade. The hole, after it is cut, can be filed to any desired shape. The pot is held against the wall where it is to be fastened by leaning a post or board against it.

For a cement for fastening, plaster of paris is to be preferred to Portland cement for light work, and also for its quick setting qualities, which may be hastened by adding a little salt. The plaster should be applied rapidly about the rim of the pot, and against the wall, till a perfect union is formed. The pot and the wall must be first dampened with water, or the plaster will not adhere.

After the plaster has set, the board prop is withdrawn, and work on another pot begun. When all the pots are fastened in position, the plaster is given twenty-four hours to dry and harden before putting on the rough coating, as the weight of this coating might break away the pots. The rough coating is applied as shown in Fig. 3, with a broad bladed table knife, or "pointing" trowel. I load the trowel with plaster; with the left hand I urge the flow of the plaster from the point of the trowel with a stick, the point of which has been well greased or soaked in oil, to prevent the plaster adhering and forming a knob.

When it is desired to make the bird houses look more picturesque, pieces of lichens and wood mosses may be fastened on with plaster; small branches of the vine may also be brought down and around the pot, and for a perch or rest in front of the entrance, a dead twig or branch may be used. These are also fastened to the pot with plaster.

After the plaster is perfectly dry, it should get a heavy coat of boiled linseed oil, mixed with a dull green, brown, or neutral tint. The oil protects the plaster from the action of rain and the atmosphere.

Fig. 2 is a hanging bird house. It consists of a nine-inch flower pot and an old milk pan. A hole is made in the bottom of the pot and pan large enough for a turned picket or stick to pass through, and to allow for the fastening of the straw which is to form the thatched roof. A hole is bored through the picket into which a cross pin of wood or iron is inserted, on which the bottom of the pan rests, otherwise it and the pot would slip off.

The milk pan is punched full of holes to allow the plaster to pass through and clinch, as it will not adhere to the smooth surface of the tin. In applying the plaster to the pot, I use an extra quantity on the inner bottom of the pan, to more firmly unite the pot and pan together. After the plaster has hardened, the rough coating is applied as before described. The pan, after it is filled with earth, is planted with tradescantia, German ivy, or Madeira vines, which will cling and twine to the brush cat screen. I have also used some of the more hardy of the succulent plants, such as house leeks, creeping charley, and semper vivum metallica, etc

The cat screen is made of the branches of black alder firmly bound to the picket, some two feet below the bottom of the pan, against which they press and radiate out, forming an effectual obstruction to cats, as well as looking very ornamental when the vines are growing among the mass of branches, buds and burrs.

The best and most ornamental woods

for making these screens are red birch (with the cones on), spruce with its rich buds, and sweet gum tree (liquid amber). These are all very pliable, and easy to handle. In making the thatched roof, the straw is first bound to the top of the picket with wire; it is then brought down to the top, extending over so as to form a continuous eave. The dishing of the thatch roof is controlled by the wire or twine stitching, which holds the straw together.

Fig. 3 consists of two 14-inch pots joined together at their rims *very firmly* with plaster. The lower pot is fastened to a large sized milk pan, and through the milk pan and pots passes a stout pole extending well out of the upper pot, on which is fastened the double thatched roof. The third roof of thatching is bound on with wire just below the rim of the lower pot, around which is formed a shoulder of plaster, otherwise the wire binding would slip off. This bird house can be divided into as many compartments as desired.

Where a number of pots and pans are to be fastened together, great care must be taken to firmly unite the parts together with a bountiful quantity of plaster, laid on thick. Much taste and skill can be displayed in the different designs formed on the pots with the plaster, but care must be taken to have them in good taste and in keeping with the surroundings.

Lessons in Magic—V.

I WILL suppose that you, my reader, are to give an exhibition of conjuring, and let me here suggest that when you do appear either in public or in private, that you use the plain, old-fashioned word "Conjuring," in preference to those high-sounding affectations, "Prestidigitation," and "Thaumaturgy." Well, your programme is prepared; your stage and apparatus arranged; the bell tinkles, the curtain rises, and you walk to the footlights and make your bow. Of course you are expected to make an introductory speech, and you do it in a few words, and then begin your performance with—well, I will suppose with

The Egg Ching-Ching.—This title has really very little reference to the trick, but then a title is absolutely necessary, and as this conveys no idea of what you are about to exhibit, it is as good as any other.

For the trick you use an egg, a glass goblet and two handkerchiefs, one large cotton one, and the other a small one about eleven inches square, made of red silk.

The goblet you place in the hands of one of your audience, and then select an egg from a number in a dish; the cotton handkerchief is spread over the left hand, and on it is laid the egg. You now approach the person who holds the goblet, and, asking him to hold it above his head, you cover it with the handkerchief, and at the same moment drop the egg gently into the glass.

"You all heard the egg drop into the glass," you say; "Now, Sir,"—addressing the gentleman who holds the goblet—"be good enough to shake the glass, very carefully, however, so as not to crack the egg, and tell the audience whether you think the egg is still there."

"You think it is? Very well. Now, ladies and gentlemen, watch me carefully, and you may detect the little piece of sleight-of-hand which I am about to attempt."

You proceed to turn up your coat cuffs, that all may see you conceal nothing there, and taking the small red silk handkerchief by one corner, with your right hand, say, "I use a red handkerchief for this trick purposely, as it contrasts very decidedly with my shirt cuffs, and should I attempt to conceal it in my sleeve, you would detect me. Now, if you will watch sharply, you will see it gradually disappear."

Place your hands together, with the handkerchief hanging from between them; move the hands slowly up and down, and, to the surprise of all, the handkerchief will be seen to gradually creep into your hands, until at last it entirely disappears. You open your hands, and there is—not the handkerchief—but the egg. This you place in an egg cup on your table, and then running to the person who holds the

goblet, you pull off the handkerchief which covers it, and there inside is the red handkerchief snugly stowed.

"Examine those carefully," you say, "and I will show you something more of the wonderful qualities of the egg."

But before going further, I will give the explanation of "The Egg Ching-Ching." As real eggs are apt to get broken, get a turner to make you a lot of wooden ones, which you have painted, some of a bluish white, and others of a light cream color, so as to look as near like the genuine article as possible. Into one of these drive a small staple, which you may easily make by cutting the head off a pin, and then bending it back till both ends meet. To this staple you fasten one end of a piece of thread, and the other end to the centre of the cotton handkerchief. Next you get *two* pieces of red silk—the kind known as Florence or Marceline is best, as it is flimsy and soft—and, finally, get a tinsmith to make a tin egg, with a hole in one side to admit of one of the pieces of silk being placed inside; this egg you have painted the same color as the wooden egg which has the staple in it. Your apparatus is now complete. Before commencing the trick, fold one of the pieces of silk into as small a package as possible, and place it in the cotton handkerchief, putting the tin egg under your waistcoat.

Approaching the audience, you keep the centre of the cotton handkerchief in your left hand, holding it in such a way as to conceal the piece of silk and the wooden egg.

Now call for some eggs, and when one is selected by the audience, take it in your right hand, throw the cotton handkerchief over it, and whilst it is covered, conceal the egg, either by dropping it in your sleeve or tucking it into your waistcoat. Withdraw the right hand, and tell the audience that the egg is under the handkerchief; they will probably doubt you, but to convince them that it is so, you pull up one end of the handkerchief and show the wooden egg, which will satisfy them. Now request some one to hold a goblet; throw the cotton handkerchief (which you still hold by the centre, to prevent the piece of silk from dropping) over it, and place the wooden egg and the piece of silk in the goblet.

Ask the person who holds the glass to shake it, so that all may hear that the egg is really inside. Being convinced that it is there, you produce piece of silk No. 2, which you allow the audience to examine, and then return to the stage. As you go on to the stage, you take the tin egg from under the waistcoat, and hold it concealed in your right hand. Take the piece of silk between your two hands, and begin waving them about, and at the same time manage, by means of your thumbs, to tuck the silk into the egg. When it is entirely in, close the right hand over the egg, and, going to the glass, lift up the handkerchief, being careful at the same time to take the wooden egg out. The audience, seeing *a* piece of silk in the glass, will suppose it is the same you held a moment before; and as you open your hand and show an egg in it, they will take it for granted that it is the one that was in the goblet.

As some inquisitive person may want to examine the egg, you may change it for a real one in this way. Have a little pocket cut in each side of the skirts of your coat, at just about the spot that your wrist would reach if your arm was dropped to its full length.

As you conclude your trick, approach some person on your left side, holding the tin egg in your right hand. Ask the gentleman if he will be kind enough to look at the egg and see that it is perfectly good. As he extends his hand to take it, you pretend to put it in your left hand, but retaining or *palming* it with the right, let that hand drop to your side, and slip the egg into the pocket in your skirt. The left hand, which is closed and supposed to hold the egg, you put out, to meet that of the person who is to receive the egg, and at the moment your hands meet, you open your left, and all are astonished to see that it is empty.

"Would you like to know where it is?" you ask. "See here." Open your waistcoat at the place where you hid the egg which was chosen first for the trick, and show it.

Engraving on Wood—II.

BY SARAH E. FULLER.

IN our last paper we told you how to make a drawing on wood, and we will now give some instructions in the practice of engraving. But first we must describe the necessary apparatus and tools.

A set of tools usually contains four or five sorts. When we speak of them generically, we call them all gravers, but when we classify them, we name the tint tools first. These are so named because tints are usually cut with them. They are made so that it is easier to cut tints with them than with the third class, which are technically called gravers or lozenge tools. This was the form used at first, and such tools still retain the name of gravers. All classes of work can be done with gravers, but it is usually found more convenient to use the tint tools for cutting tints; the gouges for cutting or "digging out" large spaces of wood; and the chisels for lowering the wood at the edges, and other parts of the picture. The gravers are useful in taking out minute dots of wood, irregular shapes, and also places with square corners. For convenience we classify and number them in the following order: First the tint tools, of which from seven to twelve in number will be necessary. These are graduated from a very fine tool—so fine that the cut it makes will hardly show when printed—to one that will cut a coarse cut, say about one-twentieth of an inch in width. The engraving (Fig. 4) shows the graduation from No. 1 to No. 11; "A" shows the side of the tool. The tint tools should be straight on the bottom, and the edges formed by the bottom and the sides should be slightly rounded, so that the tool will cut more smoothly than if the edges were square. The sides should slant from the bottom, to the top or back, which may be round or square. If the tool is no thicker at the top than the bottom, it will stick, and hang in the wood, and the lines cut, will be liable to break down in printing. A section will appear like Fig. 5. When thicker at the base than at the top, a glance will show that they will have more strength, a section appearing like Fig. 6.

Fig. 5.

Fig. 6.

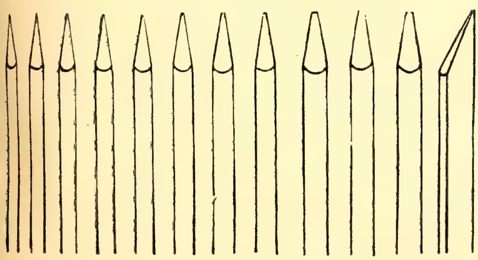


Fig. 4.—TINT TOOLS.

The second classs of tools are the gouges, or digging out tools. Of these two or three only are necessary. It is usual to have the smallest gouge make a cut that will grade next larger than the largest tint tool, and the largest gouge—large enough to take out the largest spaces. Gouges numbers 12 and 13 are large enough for general use, but if the engraver has much work requiring large spaces taken out, it would be well to add a gouge considerably larger than 13. The gouges are better for being round upon the bottom.

Fig. 7.

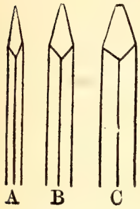
The third class of tools are the gravers, or lozenge tools, their form being lozenge in shape (Fig. 8). Two or three are sufficient. They are marked, for convenience, with the letters A, B, C, etc.

The fourth class of tools are the chisels (Fig. 9), of which one or two are sufficient. If only one is used, choose the broadest one. Mark these with Roman numerals, I, II, etc.

The number of tools used by different persons varies. Some engravers pride themselves on doing the greatest variety of work with the smallest number of tools. Others, again, have a large num-

ber, with fine gradations between. In this matter, as in most things, the mean is the wisest. A set of tools consisting of ten tint tools, two gouges, two gravers, and one chisel, form a very good set.

To these may be added some two or three oval or ellipse tools, something between a graver and a tint tool, and adapted to a large variety of work. These may be marked X, XX, etc.



A B C

Fig. 8.

In the large cities we can obtain these tools, already made, and sometimes nicely graded, but engravers usually "fit up" and grade their own tools, by rubbing them on their oil stones.

Just here we will put in a caution; in sharpening the tools, we do not apply the

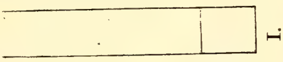


Fig. 9.

sides of the tool to the oilstone; that is only done in grading and preparing them for use.

Engravers who have mechanical skill and knowledge, sometimes make their own tools, using worn out files for the purpose, the steel in files being of excellent quality, and tempered so as to fit it for engraver's use. Some of our young readers may have skill to do this themselves, and others probably have friends, with "shops" where these tools can be made, according to the descriptions we have given.

For handles to the tools you may use wood, or cork; the shape shown in Fig. 10 is one very convenient for use. The tool

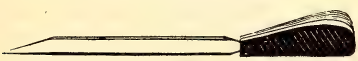


Fig. 10.

should be inserted in the handle, so that it is nearly straight, bending slightly upwards, with very little of the handle below the tool.

It is necessary to have a sand bag, or leather cushion filled with sand, so full that the block will not sink into it while you are engraving—and then again it must not be so hard that the block will slide off. You may put this cushion directly on a firm table, or on a turned piece of wood made for the purpose. It is more convenient to have the cushion raised a little above the table, but not essential; but the table must be firm, and it and your cushion at such a height that you can have your body perfectly erect, whether you sit or stand while engraving.

You can commence learning to engrave without a magnifying glass and stand, but you must not try to do fine work, because you will strain your eyes, and once injured, you may suffer all through your life. The magnifying glass, should be of moderate power—an inch and a half in diameter is a very good size, and you can consult your fancy about the frame in which it is set—wood, shell, ivory, metal, etc.—though dark tints of shell, bone or rubber, are the most agreeable to use. For a stand, you may also consult your taste and means. You need an upright rod, with an arm which holds the glass, adjustable, on it. If you have nothing better, take a thick piece of wood, eleven or twelve inches long and six inches broad, and at one end, midway from the sides, put a stout wire. Take a piece of cork, and make a hole through it so that it will slide up and down this wire. Now take a smaller wire, but one that is stiff, and pierce the cork at right angles with the upright. This needs to be long enough, so that it will extend through the back of the cork an inch or two, and come forward to the front edge of the block of wood, which will also serve as a stand for the cushion. Bend the end of the wire into a round loop, just large enough to hold the magnifying glass. You need an oilstone for sharpening the tools, and this should be fine enough to make the tool smooth, while it sharpens; and should "take hold" enough to sharpen the tool quickly. Sewing machine oil, or sweet oil may be used. Put a few drops on the stone, and place the face of the tool flat on the stone. Hold it steadily, and rub from side to side, or forwards and back-

wards, as you find most convenient. You want to grind the face of the tool so that it has one smooth face, not a number of little facets; and keep your pressure so that you do not grind away the point faster than the part near the top or back of the tool. If you are successful in always holding your tool properly, you will not have much occasion for a small grindstone. But one will be useful in grinding the upper part of the face, which being wider than the point, takes longer time to grind off, on your oilstone. But be careful how you use a grindstone; you do not need it for sharpening your tools at the point; that is best done on the oilstone. A final polish is given to the tools by the use of a leather strop.

To engrave well it is necessary to keep the tools well faced, and keenly sharp. The face of the tool should be rather long than short. If too obtuse it plows its way

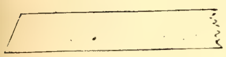


Fig. 11.

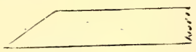


Fig. 12.

in the wood, rather than cuts it, and the shaving will also turn over at the point, and prevent the engraver seeing the line that is cut. Fig. 11 shows a tool too obtuse. But a tool of about the angle shown in Fig. 12 will cut cleanly, and the shaving will fall out so that it will not obstruct the sight of the engraver.

A soft brush (a tooth brush is good) is useful to brush away the small chips from the block. It must be soft, so as not to injure the lines of the engraving.

Learning to Use the Microscope—I.

As it is always well to begin at the beginning, it may not be out of place to give a few hints to those who have just purchased an instrument. When a microscope is first brought home, the purchaser is in general in a great hurry to examine it, and in this case especially the old proverb holds true, "The more hurry the worse speed." The first thing to be done is to carefully unpack the instrument, and see that the articles which accompany it correspond with the bill. In unpacking, beware of using any undue violence. Remove the packing material, but do not throw it away until you are satisfied that no little loose piece or accessory has got mixed with it. Then lift the microscope carefully out of its case. This should require no unusual force; a little patience will bring all right, whereas if you push and press, some part will very likely get bent or perhaps broken.

The next step is to free the instrument from dust, for no matter how well it may have been protected, dust will almost always penetrate during the shaking which occurs during travel. Dust is most easily removed by means of a soft camel hair pencil. Wiping with coarse or dusty cloths will infallibly scratch and injure the glasses.

We are now ready to begin the use of the microscope, and here, as in most other studies, "it is the first step that costs." After we have once made a beginning, it is easy to improve our skill and knowledge; the difficulty is to make the beginning.

It is always best for the beginner to commence with objects which are already mounted, and which consequently require no preparation to fit them for examination. It is well, therefore, to order half a dozen or more objects with the microscope, so that the material for preliminary practice may be at hand. The list should include such objects as require the most dissimilar methods of handling and illumination. Thus, for example, it should include the simplest transparent objects; objects that can only be examined by reflected light, and that require good illumination; objects that have finely marked surfaces, etc., etc. A list which will be found very interesting, which are easily procured, and which will give the beginner good practice, are: 1, a section of wood (either stained or colorless) mounted in balsam; 2, a piece of a butterfly's wing for examination as an opaque object; 3, a section of pith of plant, mounted dry, and which can be examined either as an opaque object or as a transparent one; 4, butterfly's scales, detached from the wing; 5, wing of a mosquito; 6, diatoms.

To be continued.

Bust Modelling—III.

BY ADELAIDE F. SAMUELS.

WHEN you are ready to cast the bust in plaster, the first step is to roll and pound flat on a board, a strip of clay, that will be long enough to reach from one shoulder on the bust to the crown of the head; have the strip about three inches wide, and one inch thick; stand this strip up on the bust, from the shoulder to the top of the head, bending it in to touch the neck, and letting it pass up *just behind the ear*. Press it on all the way up so that it will stay, then make another strip for the other side, and join them at the top, as shown in Fig. 8.

Fig. 8.

Now take an earthen bowl that will hold from two quarts to a gallon, fill it two-thirds full of water, and into the water pour your plaster of paris slowly, until it takes up all the water, and becomes of the consistency of cream. Stir a few times with a large spoon to get out the air, then, with the spoon, throw the wet plaster upon the face of the bust, *blowing it* into every crack and cavity, the while, until you are sure the whole surface of the face is covered. It must be done very quickly, for if the plaster is allowed to harden at all before it is thrown on, there will be air holes between the clay and it.

After the plaster has been applied, mix another bowl full, and continue to mix and lay it on, until the *whole front* of the bust has a covering of plaster as thick as the clay strips are high, that is, about three inches thick.

In Fig. 9, A shows the clay partition, and B the plaster, as it should be put on.

After the front is done, peel off the clay strips, and with a brush wet with water and clay, saturate the edge of the plaster, or all of it that rested against the clay strips; this is done to prevent the back of the mould from sticking to the front.

Now mix more plaster and apply it to the back of the bust, until that is as thickly covered as the front. Smooth it off, while wet, with a broad-bladed knife, and press it against the front, leaving the line discolored by clay and water visible between the two.

After the plaster is hard enough, which will be as soon as it ceases to feel warm, turn the bust carefully on one side, and with a large knife, cut and pull out all the clay up to the neck. Now separate the front of the plaster mould from the back. If they do not separate readily, place a chisel on the discolored line, and hit it gently with a wooden mallet; follow the line up, until the parts separate, when you can easily remove the remainder of the clay; while removing it, care must be used that the knife does not disfigure the mould inside. Now put the two parts of the mould in a tub, cover them with water, and let them remain over night. This is done to take all the *life* out of the plaster, that it may not adhere to the cast.

In the morning you can put the two pieces together, after washing off the clay that still adheres to them, and keep them in place by winding a strong cord securely around them; then mix your plaster, as before, and pour it into the mould, a bowl full at a time, and after every bowl full you must roll, and turn, and tip the mould until the plaster penetrates into every part of it; do this until the plaster inside the mould is about three inches thick, when nothing more can be done that day, as the cast must have time to harden, or you will be likely to break it.

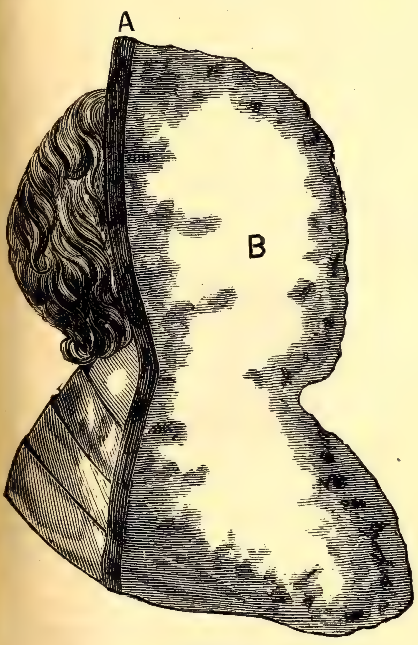


Fig. 9.

The next day you can get out your mallet and chisels.

Plaster workers have a particular kind of chisel, like that shown in Fig. 10. If you live near a blacksmith, you could easily have a large and a small one made; if not, you can make ordinary chisels answer.

With your mallet and largest chisel, begin at the lower edge of the bust to "*chip off*" the mould. It is delightful to see the face you worked so long at in the clay, appearing in the plaster, as the mould disappears. Do not *dent the cast with the chisel* if you can possibly avoid it. If you should do so, mix a little fresh plaster and fill the dent with it. You must use a small chisel to do the fine chipping about the face, and be *very careful* not to disfigure the features. If you should *break* any

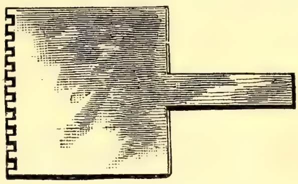


Fig. 10.

part of it, you can mend it again by making the edges rough, and joining them with wet plaster.

After the mould is all off, place the cast where it will dry, and give all your attention to the *Pedestal* to mount it on. You can buy one for a trifle at the image-caster's, but if you prefer to make one, you must proceed in the following manner. Model in clay one shaped like Fig. 11, having the circumference of the bottom about the same as the circumference of the head. After it is modelled, give it a covering of plaster two inches thick, for the mould; then remove the clay, and after washing the mould and letting it

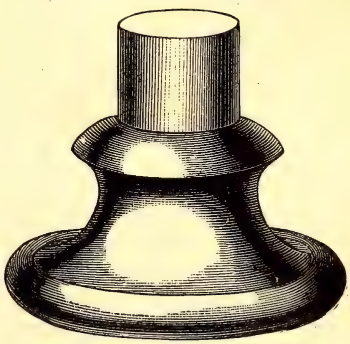


Fig. 11.

stand a while in water, fill it full of wet plaster; when that is hard, chip off the mould as before, and you have your pedestal. Insert the top of it in the opening in the bottom of the bust, be sure that it will *stand straight*, then fill in all around it

with wet plaster, and let it remain until perfectly hard.

When the bust is *quite dry*, get some very fine sandpaper and rub off the line caused by the joining of the mould; then give it a few finishing touches and it is done.

To make any number of the same bust, a *piece mould* must be constructed. They are very complicated, and difficult to make, and are never attempted but by professional casters.

How to Grind Convex Lenses.

BY R. M. BAILEY.

TO many persons the process of shaping and polishing glass lenses seems beyond the powers of those who have not the acquired skill and the mechanical appliances of the professional optician. But this is not the case. Any one of fair mechanical ability, and with means that are to be readily obtained almost anywhere, can produce good magnifying glasses of any desired powers within certain limits. Perhaps it is not too much to say that first-class convex lenses can be made by any reader of THE YOUNG SCIENTIST, after a little practice. We will show how this can be done.

Any turning lathe having the end of the mandrel hollow, can be used as a grinding and polishing machine, and is all the machinery that is required. The Lester scroll saw, with lathe attachment, answers very well for grinding microscope lenses.

Decide upon the focal length of the lens you wish to grind, and also whether it shall be plano-convex or double-convex. If plano-convex, set a pair of dividers to half the focal length required; if double convex, set them to the whole focal length. We will suppose that you wish to make a plano-convex lens of one-inch focal length, which will magnify ten diameters. Set the dividers to half an inch, and upon a piece of sheet brass, or zinc, strike a quarter or third of a circle. With shears or a narrow cold chisel, cut out the inner part of the circular segment, finishing, with a half round file, carefully and exactly to the mark. You thus have a concave gauge like Fig. 1.

Next procure a strip of thick saw blade or other flat steel, not over an inch in width, and long enough to be conveniently handled. An old chisel will answer well. Grind one end to a convex shape that will exactly fit the concave gauge, giving it a sharp cutting edge of large angle, not less

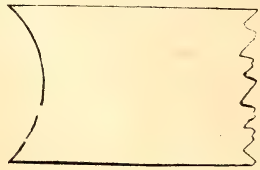


Fig. 1.

than sixty degrees, rounding off the other angle, so that on holding it edgewise, the edge will appear like Fig. 2. Fig. 3 represents the edge of this gouge, as we will call it, when completed. It must fit the concave gauge so exactly that on placing the edges together no light can be seen between them. The curve must be the

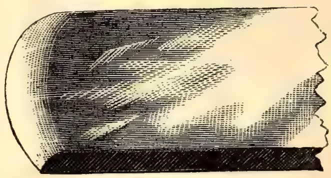


Fig. 2.

same at every point in both gauge and gouge, which may be proved by fitting them together at different angles.

This gouge is to be used in making the next tool, which is a concave grinder or lap required in polishing the lens. Take a block of hard wood, plane one side smooth, and with an inch bit bore a hole

Fig. 3.

half an inch deep in the planed surface. Then in the centre of this hole bore another hole through the block, this last hole being a little larger than the hole in the mandrel of the lathe. These holes must be bored quite perpendicular to the planed surface of the block. Fig. 4 repre-

sents this block cut through the middle of the hole, to show how it is bored. Lay this block upside down upon some smooth surface, either wood or metal, preferably the latter. Now melt some block tin or tinsmith's solder on a ladle, and pour it into the mould thus placed, taking care to hold the block in place while pouring.

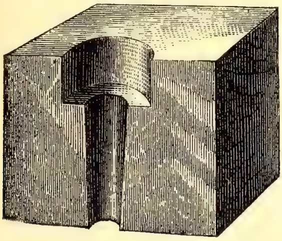


Fig. 4.

On removing the cast metal from the mould, it will present the appearance of a bolt with a circular head and without a screw thread. Centre this as exactly as possible in your lathe, putting the spur centre into the smaller end, and turn the smaller part into a spindle like that of the spur centre, so that when the spur centre is removed the tin spindle will fit into the mandrel smoothly and tightly in its place. Have it go in far enough so that the tin head will rest firmly against the end of the mandrel. A few trials during the process of turning will enable this to be done with sufficient exactness. If this has been properly done, on revolving the mandrel the end of the tin which projects

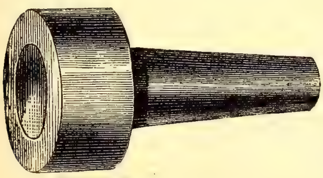


Fig. 5.

from it will be free from noticeable "wabbling" motion. Then set the slide rest of the lathe squarely in front of the tin, rest the convex gouge upon it, place the cutting edge against the middle, which is marked by the tail-stock centre, set the lathe in motion and turn the metal out until you have a smooth concavity in the end of the tin a little larger in diameter than the proposed lens; then dip a piece of slightly moistened flannel cloth into "putty powder," and polish this concavity, being careful not to polish it out of shape. This concave surface must be so true that when the convex gouge used as a gauge, is placed squarely against it, no light can be seen passing under it. Fig. 5 represents this tin polisher when finished.

The last preliminary to the grinding of the glass is to turn a piece of hard wood into the shape of Fig. 5, except that the end must be plane instead of concave, and the head should be turned down to the diameter you propose to give the lens.

To be continued.

Editorial Notes.

Our New Dress.

THE YOUNG SCIENTIST was commenced January, 1878, as a journal of twelve pages. The type was clear and handsome, but was a size larger than that used in journals of a similar class—the object being to relieve the eyes of the reader as much as possible. The journal was essentially an experiment. It was devoted wholly to *practical* matters—eschewing theory as much as possible. Its object was to describe those facts in science which could be easily verified by experiment, and to tell how to perform the experiment; and as a necessary adjunct to this all those arts most affected by amateurs and young people formed important subjects for discussion. Our first idea was that twelve pages per month would be ample, but ere long we found that additional pages became necessary, and towards the close of the year the range of subjects in which our subscribers showed an interest, and the amount of matter pressed upon our attention, demanded more room. We therefore not only added four pages, but reduced the size of the type—the result being that the amount of matter contained in the number for January, 1879, was more than one-half greater than that contained in the number for January, 1878. The pages were also elec-

trotyped, so that back numbers for the year 1879 might always be on hand.

These changes caused considerable delay and annoyance, and the result was far from satisfactory. Although our readers, wherever heard from, expressed themselves more than satisfied with the new form of the journal, we did not feel pleased with it. The type was not clear enough to suit us, and the general arrangement seemed to us capable of still further improvement. We therefore had a new font of type made expressly for this journal. The style is known as *Scotch face*, and while it is a full size smaller than the type used last year, it is much more readable, the *face* of the letters being actually larger! This seems almost a contradiction in terms, and the statement will no doubt puzzle many of our readers. We regard the production of this type as one of the marvels of the art, since it enables us to give a very much larger amount of matter in the same space, and is at the same time actually more easily read!

Now that we have completed this number under our new arrangements, we feel confident that things will go smoothly, and we certainly feel also that we have reason to be proud of the appearance of our little journal. We trust that our readers will appreciate this effort to give them the best journal possible, irrespective of labor or expense, and will excuse the unfortunate delays which have marred the commencement of the new year.

Special Offer to Our Subscribers.

THE new edition of the "Amateur's Handbook of Practical Information" has been greatly enlarged, and it now contains the very cream of the larger books on the same subject. We have the strongest possible evidence of its real value in the fact that large numbers of the first edition were sold to persons who had seen copies of it in the hands of their friends. We have had a few copies substantially bound in cloth, with gilt titles, the price of which is 30 cents; and to enable our old subscribers to procure the book easily, we will send a copy to every one that will procure us a *new* subscriber, and remit fifty cents. This offer is open only to subscribers whose names are now on our books, but any one sending two names and $1.00 can have the book.

Special Notice.

TOWARDS the close of last year, we offered to our old subscribers the privilege of obtaining their own subscriptions free, by sending the names of two *new* subscribers. This was virtually giving the YOUNG SCIENTIST for one year for 33⅓ cents. We have expended so much in improving the journal, however, that we cannot afford to do this now, and the offer is accordingly withdrawn. Our club and premium lists will still be found to be quite as liberal as those of any journal in the country.

Numbers for 1878.

WE regret to say that the numbers for March, 1878, are entirely exhausted, so that we can no longer supply full sets of the first volume in sheets. We have a few copies of Vol. I on hand, bound in cloth, with gilt title, which we offer for $1.00 by mail, postpaid.

BOOK NOTICES.

The Amateur's Handbook of Practical Information for the Workshop and the Laboratory. Second Edition; Greatly Enlarged. Price 15 cents. New York: Industrial Publication Company.

It is but a short time since we noticed the first edition of this work, and the rapidity with which this edition has been exhausted is very good evidence of the value of the book, as well as of the need for such a manual. The present edition has been greatly enlarged, so that it now contains the cream of the practical recipes found in the larger books and cyclopædias. Owing to the large circulation which it has attained, the publishers are enabled to give a good deal for the money.

The Heavens for March.

BY BERLIN H. WRIGHT.

PLANETS.—MERCURY will be brightest as an evening star March 26-29, when he will be about 19° from the sun, setting about 9° north of the sunset point, as follows:

March 23—7h. 40m. evening.
March 26—7h. 50m. "
March 29—7h. 57m. "
April 1—7h. 58m. "

On the 29th he sets 1h. 36m. after sunset, and 5 minutes after the close of twilight. If clouds do not prevent, he may be easily seen from March 20 to April 5. There are no stars brighter than fifth magnitude in his vicinity.

VENUS will be a brilliant evening star throughout the month, setting as follows:

March 10—7h. 49m. evening.
March 20—8h. 13m. "
March 30—8h. 38m. "
April 10—9h. 4m. "

She will move eastward past the stars of the constellation Pisces, the Fishes, until the 27th, and after that date in Aries, passing Neptune April 1, being about 2° north of him. She will be about 5½° south of the Moon on the 25th.

MARS will be in the constellation Sagittarius, the Archer, until the 20th, and afterward in Capricornus. On the 18th he will be directly south, about 5°, of the three stars which mark the head, or, rather, one of the horns, of the Goat. This is the only cluster by which the constellation can be readily recognized. The two extreme stars are of the third magnitude, and about 4° apart, being nearly in a north aud south line. The middle star is dimmer, being of the fourth magnitude. He rises as follows:

March 10—3h. 54m. morning.
March 20—3h. 41m. "
March 30—3h. 26m. "
April 10—3h. 6m. "

He will pass south and very close to the Moon on the 17th. This conjunction will be witnessed in Europe as an occultation.

JUPITER may now be seen in the east as a morning star, rising as follows:

March 10—5h. 32m. morning.
March 20—4h. 58m. "
March 30—4h. 4m. "
April 10—3h. 47m. "

He is moving eastward past the stars of the constellation Aquarius, and during the latter part of March and first of April will be about 10° directly south of the ⅄, a plain figure which marks the northern limit of that constellation. He will be about 3¼° south of the Moon on the 20th.

SATURN, being in conjunction with the Sun on the 26th, will be unfavorably situated throughout the month. After March 26 this planet will be seen in the east as a morning star.

URANUS passes the meridian as follows:

March 10—11h. 1m. evening.
March 25—10h. 0m. "
April 10—8h. 55m. "

NEPTUNE is too near the Sun to be observed.

METEORS.—Meteoric stones have fallen with more or less regularity upon the following dates: March 6, 12 and April 1.

OCCULTATION OF *Alpha* SCORPIONIS (ANTARES) BY THE MOON.—The brilliant red star, Antares, will be occulted by the Moon April 10, in the morning. The occultation will be visible throughout the Southern States south of Virginia, north of which it will be a very close approach, the star being north of the Moon. The nearest approach in New York occurs about 2h. 27m. morning, when the star will be about ⅛° north of the Moon's northern limit.

POSITIONS OF THE PRINCIPAL CONSTELLATIONS AND STARS FOR MARCH 15, 9 P. M.:

East of the Meridian—Leo Major and Minor, Virgo, Libra Bootes and Berenice's Hair. Stars—Regulus, Spica, Denebola and Arcturus.

Near the Meridian—Cancer and the head of Hydra.

West of the Meridian—Gemini, Canis Major and Minor, Auriga, Taurus, Orion and the Hare. Stars—Castor, Pollux, Procyon, Sirius, Capella, El Nath, Betelguese and Rigel; also the following clusters: The Kings in Orion, and the Hyades and Pleiades in Taurus.

Towards the Pole—Above, the Great Bear's Head; to the right, Ursa Minor, containing the Little Dipper, the body of the Great Bear, containing the Great Dipper and Draco; to the left, Cassiopeia, containing the Chair, and Perseus.

EPHEMERIDES OF THE FIRST MAGNITUDE, STARS, ETC., FOR MARCH 20:

		H.	*M.*	*Amplitude.*
Alpheratz,	sets,	8	1 eve.	39° +
Mira,	sets,	8	9 eve.	5° —
Algol,	sets,	0	20 morn.	59° +
Pleiades,	sets,	11	16 eve.	32° +
Aldebaran,	sets,	11	24 eve.	22° +
Capella,	sets,	3	27 morn.	71° +
Rigel,	sets,	10	47 eve.	11° —
Betelguese,	sets,	0	25 morn.	10° +
Sirius,	sets,	11	48 eve.	22° —
Procyon,	in meridian,	7	41 eve.	7° +
Regulus,	in meridian,	10	9 eve.	17° +
Spica,	rises,	8	3 eve.	14° —
Arcturus,	rises,	7	6 eve.	27° +
Antares,	rises,	0	13 morn.	36° —
Vega,	rises,	9	46 eve.	56° +
Altair,	rises,	1	26 morn.	11° +
Deneb,	rises,	10	49 eve.	69° +
Fornalhaut,		invisible.		

By the aid of the above, the amateur observer will have little trouble in recognizing all of the principal stars, clusters and constellations.

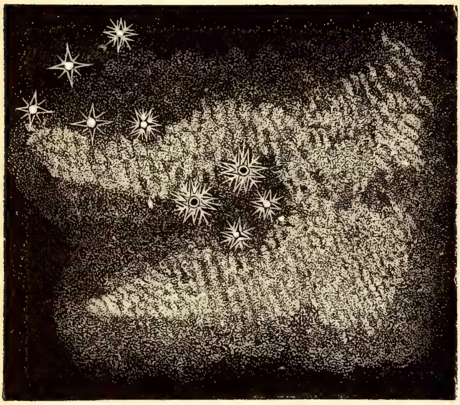
ALGOL—MINIMA:

March 3—1h. 4m. morning.
" 8—6h. 42m. evening.
" 23—0h. 50m. morning.
" 25—9h. 40m. evening.

ORION AND ITS TELESCOPIC OBJECTS.—In this constellation there are seventy-eight stars—

two of the first magnitude, four of the second, three of the third, and the remainder of dimmer grade. There are three small and one great nebulæ, three clusters, and twenty-six double stars in this remarkable constellation. We will only call attention to those objects which are of the greatest interest, and which come within the scope of a 3½-inch glass.

The greatest nebula is 42 Messier, situated about 4° directly south of the middle star of the belt, or Ell and Yard. A line from Rigel to the lowest star in the belt, will pass very close to the nebula, it being somewhat nearer to the dimmer star. It may be seen with the naked eye on a moonless night, as a dull patch of light. In the illustration will be seen the appearance of the Great Nebula, viewed with a 3-inch telescope and a power of 76 diameters.



GREAT NEBULÆ IN ORION.

In the opening on one side is situated the stars which form the celebrated "Trapezium of Orion," upon which so many telescopes have been tested. We believe the best instruments reveal nine stars in the Trapezium. If the light-gathering power of a 3½-inch glass be good, five ought to be seen; with a 3-inch glass, four; and with a smaller aperture only three. Herschel, with his great reflector, hoped to resolve this nebula, but failed, and until the great spectroscopist, Huggins, proved it to be a gaseous collection, it was believed to be resolvable.

Rigel, the bright star below the belt, is a noted double, and a severe test for small telescopes. The secondary is of the seventh magnitude according to Proctor, and ninth according to Darby. Distance, 9.5″. We have seen the companion with a 3-inch aperture, and it is believed that 2¾ inches will do it. A moderately high power should be used. A 3-inch glass will show the northernmost star of the belt double, and a somewhat larger instrument will show the southernmost to be also double.

On a line from Betelguese to Aldebaran, and about 6° from the former, is a cluster of three stars—one 4th magnitude, and two 5th magnitude. The brightest one is the most northern, and a 3-inch glass shows it double; a 3½-inch, triple.

About one degree from the lowest star in the belt, or Ell and Yard, and on a line from that star to the Great Nebula, is situated a beautiful and easy multiple star—Sigma Orionis. A good 3½-inch objective with a high power will show this star octuple, and smaller instruments fewer—sextuple, quintuple, etc. The astronomer, Struve, saw fifteen stars in this group.

Penn Yan, N. Y.

Practical Hints.

Optical Delusion.—Take three differently colored wafers—red, violet, and orange—place them upon a large piece of white paper, in a triangular form; hold the paper in a strong light, and fix the eyes upon the wafers, gazing upon them steadily for two minutes; then turn them away from the wafers to a blank part of the paper, and you will see three spectral wafers, but the colors will be different; the red wafer will now be represented by a green one, the violet by a yellow, and the orange by a blue.

Japanese Matches.—Lampblack, 5; sulphur, 11; gunpowder, from 26 to 30 parts—this last proportion varying with the quality of the powder. Grind very fine, and make the material into a paste with alcohol; form it into dice about one-quarter of an inch square, with a knife or spatula; let them dry rather gradually on a warm mantelpiece, not too near a fire. When dry, fix one of the little squares into a small cleft made at the end of a lavender stalk, or, what is better, the solid straw-like material of which housemaids' carpet-brooms are made. Light the material at a candle; hold the stem downward. After the first blazing off, a ball of molten lava will form, from which the curious coruscations will soon appear.

Decoration of Zinc.—A chemical process for covering zinc with colored coatings has lately been described by Dr. L. Stille. The articles of zinc are first brightened by scouring with quartz sand, moistened with dilute muriatic acid, putting them quickly in water, and then carefully wiping them dry with white blotting paper. To ensure success, however, it is necessary to employ zinc as free as possible from lead, and to have it as bright as a mirror. When these conditions are fulfilled, the metal may be coated with a variety of beautiful colors by immersion in a solution of alkaline tartrate of copper for a shorter or longer interval of time, depending on the color that is desired.

Varnish for Stained Woods.—A solution of four ounces of sandarac, one ounce gum mastic, and four ounces shellac, in one pound of alcohol, to which two ounces oil of turpentine is added, can be recommended as a varnish over stained woods.

Cement for Wood and Iron.—A cement made of oxide of lead and concentrated glycerine, unites wood to iron with remarkable efficiency. The composition is insoluble in acids, is unaffected by the action of moderate heat, sets rapidly, and acquires an extraordinary hardness.

M. Camille Flarumarion, the well-known French meteorologist, having been led to believe that the moon contains inhabitants, is making an effort to procure funds to enable him to construct a refracting telescope sufficiently powerful to show them. The amount which he estimates as necessary is $200,000.

Black Varnish for Cast Iron.—For those objects to which it is applicable, one of the best black varnishes is obtained by applying boiled linseed oil to the iron, the latter being heated to a temperature that will just char or blacken the oil. The oil seems to enter into the pores of the iron, and after such an application the metal resists rust and corrosive agents very perfectly.—*Amateur's Handbook.*

Imitation Rosewood.—Boil one-half pound of logwood in three pints of water till it is of a very dark red; add one-half ounce of salt of tartar. Stain the work with the liquor while it is boiling hot, giving three coats; then, with a painter's graining brush, form streaks with the following liquor: Boil one-half pound of logwood chips in two quarts of water; add one ounce pearlash, and apply hot.

Cement for Steam Joints.—Take sal-ammoniac, two ounces: sublimed sulphur, one ounce; fine cast iron turnings, one pound; mix in a mortar, and keep dry. When to be used, mix with twenty times its quantity of clean iron turnings or filings, and triturate the whole in a mortar; then wet with water until of proper consistence. A red putty for steam joints can be made of stiff white lead worked well in red lead powder.

The latest experiments with guns of the largest size are quite interesting. The highest velocity imparted to the shot is 1,626 feet per second. This is equal to a mile in a very little more than three seconds (3.2 seconds). The pressure on the interior of the gun was 19½ tons. In previous experiments, however, where a less velocity was obtained, the pressure was 21 tons. The increased velocity is attributed to the greater size of the grains of powder used, and it is laid down as an axiom that the larger the gun the larger must be the grains of powder.

Varnish for Basket Ware.—The following varnish for basket work is said to dry rapidly, to possess sufficient elasticity, and to be applicable with or without admixture of color: Heat 375 grains of good linseed oil on a sand bath until it becomes stringy, and a drop placed on a cold, inclined surface does not run; then add gradually 7,500 grains of copal oil varnish, or any other copal varnish. As considerable effervescence takes place, a large vessel is necessary. The desired consistency is given to it, when cold, by addition of oil of turpentine.

To Make Corks Air-tight and Water-tight.—A German chemical journal commends the use of paraffine as the best method of making porous corks gas-tight and water-tight. Allow the corks to remain for about five minutes beneath the surface of melted paraffine in a suitable vessel, the corks being held down either by a perforated lid, wire screen, or similar device. Corks thus prepared can be easily cut and bored, have a perfectly smooth exterior, may be introduced and removed from the neck of a flask with ease, and make a perfect seal.

Black Varnish for Optical Work.—The external surfaces of brass and iron are generally blacked or bronzed with compositions called lacquers. The insides of the tubes of telescopes and microscopes should be coated with a dead black varnish so as to absorb the light and prevent any glare. The varnish that is generally used for this purpose consists of lampblack made liquid by means of a very thin solution of shellac in alcohol, but such varnish, even when laid on warm metal, is very apt to scale off, and thus produce two serious evils—the exposure of the bright metallic surface, and the deposit of specks on the lenses. It will therefore be found that lampblack, carefully ground in turpentine, to which about a fifth of its volume of gold size or boiled linseed oil has been added, will adhere much more firmly. The metal should be warm when the varnish is applied.—*Amateur's Handbook.*

Stretching Tracing Paper.—The thin, transparent tracing paper, used by architects and draughtsmen, can be stretched or be mounted so as to give a fine even surface, on which water-coloring and shading can be done as easily as upon mounted paper. Cut a piece of drawing-paper the size of the drawing-board; gum the upper surface edge of the board, about half an inch in width; spread the tracing paper carefully over the drawing, and smooth down on the gummed edge; then turn the sheet back, and gum the remaining three edges of the board; bring over the tracing paper, and smooth down the edges; do not pull or twist the sheet, so as to get it tight or severely strained, but get the edges well held down by the gum. After the gum has dried, a clean sponge, well saturated with water, may be passed over the entire surface, except on the gummed edges. The tracing-paper expands and blisters all over, but in a few minutes the dampness evaporates, and a beautiful surface is presented, similar to a transparent slate. The tracing can now be colored or shaded as on drawing paper, and any blots or errors can easily be washed out.

Exchanges.

Yearly subscribers to the YOUNG SCIENTIST have the privilege of inserting three exchanges (or one exchange three times) during the year. This privilege is strictly confined to *exchanges; buying and selling* must be carried on in the advertising columns, where the charge is 30 cents per line. Each exchange is limited to thirty words, making about four lines, and in order to receive attention must be written on a slip of paper by itself. We file all letters received and have no time for copying out exchanges and queries.

As we desire to make the journal of the utmost value to *all* and not merely to serve the interests of individuals, we shall strictly adhere to these rules, which are certainly liberal, giving as they do advertising to the value of $3.60 free to each subscriber.

A combination scroll saw and lathe, cost $16.00, to exchange for a printing press or type. C. H. Parker, Coldbrook Springs, Worcester Co., Mass.

A bill boka board, in perfect condition, cues and balls, cost $8 very recently, in exchange for a scroll saw in good condition. S. F. Allen, 47 W. 12th st., city.

Scientific American, 1870 to 1878, over 450 Nos., not bound, to exchange for good Natural History, opera glass, watch, gun, or offers. J. T. Bell, Franklin, Pa.

Groff's Model Suburban Architecture wanted in exchange for Nicoll's Railway Building, Templeton's Practical Examination of Steam and Steam Engine, and Colburn's Locomotive Engine. All entirely new. F. H. Jackson, Angelica, N. Y.

Wanted, a small turning lathe, state what is wanted in exchange. Ralph A. Pillsbury, P. O. box 555, Belfast, Me.

To exchange, beautiful rose, milk, greasy and smoky quartz, graphic granite, orthoclase, etc., for aboriginal relics, coins, or other minerals. Prof. C. L. R. Wheeler, Bedford, N. Y.

A collection of invertebrate fossils, accurately labeled and worth $225, to exchange for good microscope. The instrument must be of modern make, and in first-class condition. S. Calvin, Iowa City, Iowa.

A collection of foreign and dept. stamps, or a large collection of bird eggs of the Southern States, for a set of drawing instruments or books on plain and ornamental penmanship. Address Q. R. S., Mt. Pleasant, Washington, D. C.

Wanted almost anything in exchange for a complete set of cabinet maker's tools. The chest alone is worth twenty-five dollars. Address Mr. Clark, P. O. box 37, Brooklyn, N. Y.

For exchange, two good dial telegraph instruments, and two good Morse telegraph instruments, for printing press or bracket saw. James Scott, 20 Patchen ave, Brooklyn.

A card printer, type and cards worth $1.50, and the book "His own Master" will exchange separately or all together, books, or offers. Geo. R. Simpson, Janesville, Iowa.

A stationary cylinder steam engine, or hardware goods in exchange for an electric call bell. L. J. Otis, 973 Prairie Ave., Chicago, Ill.

Wanted for a good Gundlach No. 4 (¼) Objective, a 1½ or 2 inch Objective of wide angle. C. Onderdonk, Brooksburg box, Madison, Ind.

A spy glass costing five dollars, to exchange for a companion scroll saw and turning lathe in good condition. John Buck, Brazil, Clay Co. Ind.

Forty good photo-lantern slides, plain and colored, for a good printing press and outfit; or a small screw cutting lathe; or first class microscopic objectives, or offers. Wm. R. Brooks, Phelps, N. Y.

Wanted, a small rifle, in good order, bore 22-100, for a telegraphic key and sounder, instruments are made of brass finely wrought, mounted on a japaned iron base. Louis E. P. Smith, 6 Alpine st, Boston, Mass.

Ferns, mounted or unmounted, for Northern species of same. List of those on hand and those wanted sent on application. Maj. R. H. Wildberger, Ky. Mil. Inst., Farmdale, Ky.

Two good business lots, central, in Ellsworth, Kan, for good microscope, accessories and books, chemical balance, or gold watch. Wm. Zimmerman, 114 Dearborn st, Chicago, Ill.

To exchange, a collection of 500 rare stamps, with book which cost $1.50. The whole worth about $7.00. State offers. Albert N. Webster, 106 South Park ave, Chicago, Ill.

Hinkley knitting machine, worth $40, for a watch or breach loading shot gun, Harry Holden, Black Earth, Dane Co. Wisconsin.

One dozen (assorted) mounted objects for microscope, cost $2.50 (By J. W. Queen & Co.) for useful books on any subjects, or old U. S. coins. W. M. Stribling, P. O. box 350, Circleville, Pickaway Co, Ohio.

Cabinet mineral specimens, for Masonic publications, or other instructive books. Light reading not wanted. J. P. Clough, Junction P. O., Lemhi Co. Idaho.

Swiss watch lathe, brass, steel shaft and box, cost $25. Also a gear cutting lathe nearly complete. Exchange for minerals, microscopic slides and books. H. A. Cutting, Lunenburg, Vt.

Twelve dollars worth of parlor tricks, very best make, in exchange for a good microscope or a scroll saw with lathe attachment, of equal value. Prof. C. H. Houghton, Middleboro, Mass.

Book on magic, cost $2.50, for back numbers Young Scientist, and foreign stamps. Omega, Post Warrensburg, Mo.

Wanted, Parrishes Pharmacy and chemicals. State what is wanted in exchange. C. O. K., 1520 Fairmount Ave, Phila.

Stereoscopic views of New York city and vicinity, in exchange for fossils from the Western states and terri tories. T. P. Wendover, P. O. box 1862, N. Y. city.

Chemical apparatus or balance, spy glass or saw wanted, in exchange for novelty printing press, with sixty fonts of type. Alex, 151 East 33d st, N. Y.

Microscope worth $7.00, and cabinet with forty good slides; for better instruction or other educational apparatus. Particulars on application. Arthur Hobart, Penn Yan, N. Y.

Wanted a copy of Bourne's Treatise on the Steam Engine, for a full set (7 vols. bound) of Technologist, cost $19.25. W. J. Allen, 256 Twenty-second st, Bkyn.

Wanted, a three wheel "velocipede" large size, state what is wanted in exchange. Peter J. Murray, box 743 Wilkesbarre, Pa.

To exchange, one Bunsen and two Smee batteries; for books on electro-metallurgy or quantative or qualitative analysis. A. W. Palmer, care of Watch Co. Springfield, Ill.

A pistol in good order, cost $3.00, in exchange for an electric bell. A. W. Honywill, 217 Cabot st, Boston, Mass.

Collection of over 500 rare stamps, including Ecuador Cape of Good Hope, Barbadoes, Honduras, etc., in exchange for microscope, minerals, or scientific publications. Jas. G. Kitchell, 345 Race st, Cincinnati.

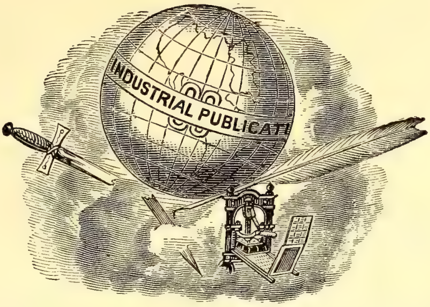
Music box, printing press, cost $35, and complete out fit for cutting stencil plate for marking clothing, cost $25, for boiler large enough for ¼ horse power. Geo A. Battles, Westminster, Mass.

Three-quarter portrait camera tube, with box and tablets all new; for books on science, medicine, history, or travel, or microscopic slides. J. S. Mason, Medina, Ohio.

Wanted, a printing press or set of draughting instruments for a C cornet (worth $30.00) or Queen's Universal Household Microscope and accessories. G. E. T., Box 475, Westboro, Mass.

The Young Scientist

SCIENCE IS KNOWLEDGE.



KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL FOR AMATEURS.

VOL. II. NEW YORK, APRIL, 1879. No. 4.

A Dollar with a Hole in It.

BY A. W. ROBERTS.

SOME two years after my tub adventure, my father obtained for me a situation in a law office in New York, where I was to receive a dollar a week: yes! a whole dollar—a dollar with a hole in it, and a silk cord through it. When my employer, Mr. Emerson, placed it about my neck smilingly, I knew that my first week at law was an established success. All the way home I wore it as a watch, taking it out every few blocks to admire, arriving home early, for I ran all the way, so anxious was I to give to my mother my first dollar earned in New York city. But when she told me I might keep it, the news was too much for me, and I had to make a bolt for the stable, to give vent to my happiness, and proclaim my good fortune to all the cows.

One day shortly after this, when examining the apple stands in John street, to ascertain if any of the two-cent apples had been placed in the one-cent apartment, I beheld an object that riveted my attention at once. In a window of a seed store was what appeared to be a glass case filled with water, and in the water were beautiful green plants and many kinds of live fish, all new to me. Every morning, noontime and after office hours, I visited the seed store, for several weeks, but what puzzled me greatly was that no one ever seemed to change the water or pay the slightest attention to the fish, yet the plants grew longer every day, and the fish more robust.

After reaching home, I dug up a handful of earth worms, putting them in damp moss to thoroughly rid them of all earthy matter. These I offered to one of the salesmen of the store, to feed the fish; he

was greatly pleased, and told me the different names of the fish, and that "you don't have to change the water because the plants keep it pure."

I wrote it down, I repeated it to myself, it was constantly in my mind, "You don't have to change the water, because the plants keep it pure." Here was a new revelation in plant life, and I thought to myself what very pure water must be contained in water-cress beds.

I was sure this plant must be foreign and costly, so taking more worms, I ventured to ask him if he would sell me a dollar's worth of the plant, at the same time displaying my dollar with a hole in it; but he could not spare any without upsetting the "balance."

Where did he obtain it?

He thought it came from Long Island, and could sell a good deal of it if he could obtain it.

What was the name of it?

Ranunculus aquatilis.

Would he please write it down, and didn't he know of an easier name? So he wrote, "Common name—White crowfoot; scientific name—*Ranunculus aquatilis;* is semi-aquatic; flowers in June; found growing in ponds on Long Island."

I said thank you, good day, and left with a feeling of fullness. Here was more light or more darkness on the subject of plants.

That afternoon Mr. Emerson noticed me reading the paper over and over, looking very much puzzled, and being very quiet; at last he asked me what was the matter, so I laid the whole case before him. I then learned that all plants have both a common and a scientific or botanical name; that the scientific name is the same all over the world, and that the common name is that by which it is known in the common language of the country or locality. For instance, the *Ranunculus aquatilis* belongs to the family of buttercups, and bears a strong resemblance to our field buttercup when growing out of the water; and for this reason I have known it to be called the water-buttercup, which I think is a much better name than the common name it bears in England, of crowfoot, as its leaves are but a poor suggestion of a crow's foot. Still that is the common name it goes by with English botanists, who first described and classified it. He also informed me that "semi-aquatic" meant growing or adapting itself either to land or water.

About this time I was given two weeks' vacation, and determined to invest all my dollar in visiting the ponds of Long Island, till I found the crowfoot. In this I was successful, and soon sold five dollars worth, with which money my first glass case (or, as I learned to call it, aquarium,) was paid for.

Dealers in stock began to spring up in all parts of the city, and the demand for aquatic or water plants increased daily, so that I found it profitable, as well as healthful and pleasant, to go into the business, and get back to the woods and flowers.

Every variety of plant I obtained was thoroughly tested to ascertain its oxygenating qualities; in this way I soon became an expert on plants and their habits, and orders came in faster than I could fill them, so that in a short time the dollar that I had first expended in search of plant knowledge was multiplied many times.

Dealers in aquatic plants are still telling the same old vague story of so many years ago, "You don't have to change the water, because the plants keep it pure." They seldom inform their customers *why* or *how* the plant life sustains the animal life contained in the aquarium, and very many of them do not know and do not care. I know a dealer who sells hundreds of bunches of plants a year; one day I asked him, in a careless, off-hand way: "W———, what on earth is carbonic acid gas?" His reply was that he neither knew nor cared what "carbolic" acid gas was. In his establishment are many varieties of plants; some of them are of no value, but they possess a bright green color, and sell well, and *rot* well when placed in an aquarium, so that after a beginner has bought several lots of these plants, he gives up in despair Many dealers say they do not want the plants and fish to live too long, as they cannot sell as much stock.

So I have carefully prepared a list of reliable plants, with drawings which I

Fig. 1.—MERMAID WEED.

made from life. This will also serve as a guide to those who collect their own plants.

Proserpinaca. Mermaid Weed; also er-

Fig. 2.—WATER THYME.

roneously called by dealers Millfoil. In the illustration (Fig. 1) I have shown it in its summer leaf, when growing out of water, gradually becoming finer as it becomes submerged with water towards winter, by which time it is in its full aquatic dress. Found in ponds that dry up in summer time. Only reliable for winter use. Does best in low temperature. Of a reddish green color to a bright light green.

Anacharis Canadensis. Water Thyme. (Fig. 2). Found growing in slow flowing streams. Is of a rich dark green color. Only of use in winter time. Requires a low temperature; not too much light, or it will spindle. After planting, heap up plenty of gravel stones on the rooting end of the bunch. It is difficult to root in the aquarium, and requires much coaxing.

Nitella flexilis (Fig. 3). Found in ponds and streams. Does well all the year round;

Fig. 3.—NITELLA FLEXILIS.

high or low temperature. Will grow without roots.

Fontinalis gigantea and *Fontinalis antipyretica.* *F. gigantea* is of a very rich deep green, with a brownish color towards the base of the plant. Found growing in springs attached to rocks. Will live and

grow after being detached. In one tank it lived for over four years.

F. antipyretica (Fig. 4). Found in springs and lakes. Is of a light green color, and is very hard to kill. I have thrown it out of the aquarium into the garden, where it was exposed to the hot sun all summer,

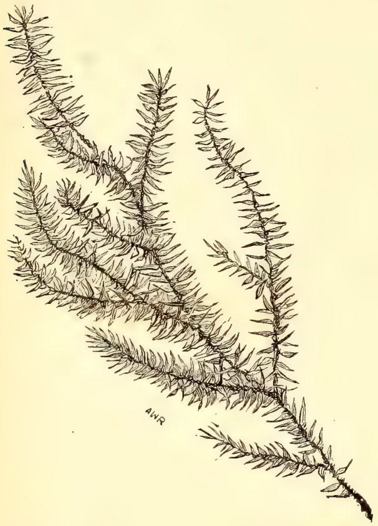


Fig. 4.—FONTINALIS ANTIPYRETICA.

but when placed in the water it started forth into a bright green mass again. All the varieties of this order of plants I consider to be equal to any plants now in use, they will stand so much abuse, particularly all the small leaved varieties, that grow in lakes and standing water. They will stand a high or low temperature, and flourish both winter and summer.

How to Grind Convex Lenses—II.

BY R. M. BAILEY.

HAVING selected a piece of crown glass, cut from the plate a piece somewhat larger than the proposed lens, and with a pair of nippers trim it as nearly as possible to a circular shape. The glass must be cemented to the end of the wooden centre. For this purpose use a cement with shellac as a basis, called by jewelers black cement. It is sold in the form of sticks. Melt the end of this in a lamp flame, and smear it on the wood, thinly but evenly. Pick up the glass and hold it in the lamp until it is quite hot, and then holding the cemented end of the wooden centre in the flame so as to remelt the cement, place the hot glass on it; press them firmly together, centering the glass on the wooden head as accurately as possible. When cold the glass is held so firmly by the cement that it will break more easily than it can be pulled off.

Put the slide rest and tail stock of the lathe out of the way, take out the centre spur, and insert the wooden spindle in the mandrel, where it must fit tightly, so as not to work loose during the grinding process. Take a small emery wheel, or a piece of a broken wheel, in the right hand, set the lathe in motion, and hold the emery stone against the glass, grinding toward the edge at first, and working it into a convex shape. During the grinding, the glass should be kept wet with water, which may be conveniently done by touching it frequently with a wet sponge held in the left hand. It must not be allowed to get so hot as to melt the cement. After it has been worked into a smooth convex surface, stop the lathe and apply the concave gauge to it, which will show where the grinding is to be continued in order to produce the right curvature. The gauge test should be made frequently after the glass has nearly reached the intended size. Toward the end, the work must be conducted very carefully, as two or three seconds' pressure of the stone upon the glass in one position will grind it out of shape. It must fit the gauge so that on removing the centre from the lathe and holding it up before the eyes, no light can be seen passing between the glass and the gauge at any point. Replace the centre, and with very fine emery paper go over it some time to remove the deep scratches left by the coarse stone, testing frequently with the gauge. Follow this with a piece of very soft whetstone. This will leave the surface in good condition for the polishing process. Grinding a medium sized lens for a magnifying glass need not take over an hour, unless a needlessly thick piece of glass has been used. The hand soon acquires the correct way of moving

the stone around, so as to give the glass a smooth convex surface.

Now tie a piece of thin doeskin or other firm and thin woolen cloth, over the concave surface of the tin polisher, fastening it around the sides of the head. Slightly moisten the cloth, and put a small quantity of putty powder (oxide of tin) over it. Remove the wooden centre, with the glass, from the mandrel, and insert the polisher. Set the polisher revolving, and, using the wooden centre as a handle, press the glass into the concavity, which it will fit accurately. Keep up the application of moisture and putty powder frequently. Do not let the glass get hot enough to melt the cement, but remove it frequently to cool. Do not hold the glass in one position, but keep the hand moving across the plane of the polisher in every direction, taking care that in whatever position the hand is held the glass fits accurately into the polisher. If the doeskin gets worn through, replace it with another piece. When the polishing has proceeded so far that the surface of the glass appears brilliant, and no scratches remain visible to the naked eye, the dampening and application of putty powder should be stopped, and the polishing continued with what putty powder has worked into the cloth. The polishing will not take very much time if the grinding was properly finished with fine stone, as directed. It should be continued, however, until under a magnifying power of ten diameters the surface of the glass appears as bright and free from scratches as it does to the naked eye.

The lens can now be heated enough to melt the cement, when it can be slid from the wood. A little alcohol will remove the cement remaining upon it. If the whole process has been conducted according to directions, the lens should give a clear bright view of any object, as the words on this page, and, while looking, no sign of distortion should be visible on turning the glass around in the fingers.

In shaping and polishing the lenses, as in everything else, practice makes perfect. Care and attention to details are all that are needed, and after the process has become familiar it will be found easy, so that any one can make for himself a supply of lenses of various powers, and even make combinations that will do excellent service.

Middlebury, Vt., Jan. 11, 1879.

The Graver.

BY JOSHUA ROSE, M. E.

WHAT a wonderful field of usefulness that simple looking little tool, the graver, fills! It is used upon wrought iron, steel, copper, cast iron, brass and wood, as well as upon ivory, bone, tin, lead, and the softer metals, and it will cut

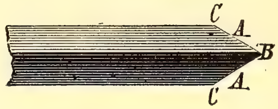


Fig. 1.

in almost any position in which its cutting edge can be brought to bear upon the work.

It consists of a square piece of steel, with the end face ground off at an angle, as shown in Fig. 1. The edges, A, A, extending on each side from B to C, as well as the point, B, being used to cut with. The machinist uses its point to cut work very true, holding it in the position shown

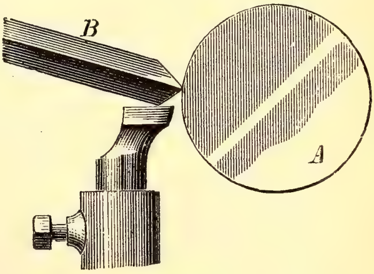


Fig. 2.

in Fig. 2, while to finish the work smooth he holds it as shown in Fig. 3. The brass finisher bevels off the face, as shown in Fig. 4, and the engraver turns it upside down as shown in Fig. 5, using the point, B, only. It will cut work that is parallel,

taper, having round corners, hollow sweeps, true curves, and moulding beads

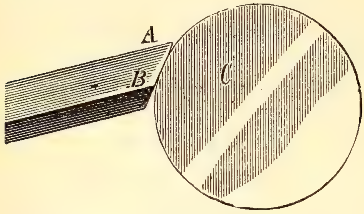


Fig. 3.

of any kind. It requires no forging, and will cut at a very quick speed. The end

Fig. 4.

face requires to be very true; hence when ground it is held as shown in Fig. 6. It is

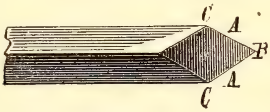


Fig. 5.

made very hard, and oilstoned for a polished finish, water being used when cutting wrought iron or steel.

When used with one point resting as a fulcrum upon the face of the lathe rest, that point should be pressed firmly to the rest to prevent the tool from slipping. Here it becomes necessary to caution the beginner against leaning the cutting edge too far over, as this is an error into which he is very liable to fall, and it invariably results in his losing control of the tool, and allowing it to rip into the work. Suppose, for example, that in Fig. 7, A is a

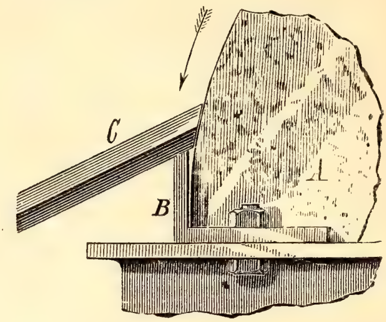


Fig. 6.

sectional view of a graver, B is the part receiving the pressure of the cut, and C is the lathe rest; the leverage of B is the distance between the vertical lines D and E, and the whole pressure of the cut at that leverage has to be resisted by a counteracting twisting pressure exerted by the hands upon the handle. The leverage of the cut as shown in Fig. 2 is, it will be

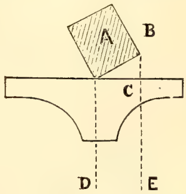


Fig. 7.

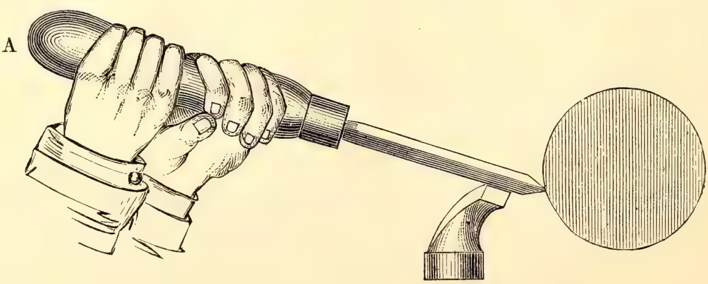


Fig. 8.

seen, much less, and therefore more under control.

The discussion of this point naturally brings us to another, namely, the shape of the handle. A file handle is often used for a graver, but it is highly unsuitable, for the graver requires, even for the smallest machine work, to be held with both hands, as shown in Fig. 8, the end of the handle, A, resting against the shoulder of the operator. The motion of the tool is given by twisting the handle from right to left, while at the same time the end, A, is moved laterally from left to right.

These facts show the wide range of usefulness which this tool covers; in skilful hands it may be made a substitute for almost every other turning tool, but it requires a little practice before the beginner learns the art of using it, and perhaps there is no test which so readily shows the skill of the turner as his power of making use of this little implement.

Engraving on Wood—III.

BY SARAH E. FULLER.

IN our second article, we said we would tell you how to engrave the flower piece, of which we explained the process of drawing. We will suppose you have your tools in good order, viz., well graded and nicely sharpened.

First lessons in engraving usually consist of exercises in making tints—at first straight line tints, and afterwards waved, curved and graduated. Then come lessons in outline work; afterwards pictures for which the work of the previous exercises has given the necessary training. At first these pictures should be simple, and, after some practice, those that are more difficult may be undertaken. But as you may be impatient to make a picture, we will tell you now how to cut the flowers and leaves in No. 2.

If you will examine very closely, you will discover a very fine white line on the inside of the edge line of the leaves, on each side of the veins, and around the flower petals. To cut this fine line, use No. 1 of the tint tools, and hold the block so that you can cut curves downwards. Use this same fine tool to cut all the darkest part of the tint, but be very cautious as your tool approaches the vein lines, so as not to cut through them. You will now find the use of the fine white outline, for as you approach the lines the little chip breaks off and drops out.

At the outer portion of this dark shade, it will be well to use your finest tool, but press it deeper into the wood than you did in the darkest part, and observe also to leave the black lines thinner than you did in the darkest part. For the next lightest tint, use tool No. 2. On the two upper leaves all the work will be done by these two tools, except a very small space on the upper left hand leaf, on its upper inner edge—there you will require your No. 3 or 4, which you will also need in the lightest tint on the large leaf.

In cutting any tints, you must use the tool that will make the gray you desire, for tints are really different shades of gray color, made up of black and white lines in alternation. Whenever you want to produce dark gray, you leave wide black lines, and cut out fine white ones. When you want it very light, the white lines are broad, and the black lines very "sharp," or "hair line."

For the lines on the stems, choose the tools that will make the different shades of gray—Nos. 1 and 2 will be the ones to use, with a higher number to make the broad white lines.

You will notice that the lines on the leaves are not entirely straight; they curve gently, and in portions are waved. The direction of the lines is generally chosen to indicate the form of the object represented.

After you have cut the leaves and stems, take a coarse tint tool, and cut across the ends of the tints on the petals, where the white spaces are, and outline with the fine tool close to the edges of the petals. Then choose the tool that will fit the tint, and hold the block so you can cut the curves downwards. Commence always at the top of any series of lines that make tints, so that each black line, as you cut it, will be above your tool, because you always need to see the line you are making.

You need to outline the stamens, but notice the little dark spot from which they

all seem to start. After you have cut the tints in the petals and the stamens, take out the white spaces, with tools best adapted. Do not try to take all out at once; several little gougings will be necessary, for here you need to cut out the wood somewhat deeper than you did when cutting the tints. Next cut away on the outside of the leaves and flowers all the blank wood, and your engraving is done. In digging out large spaces, you need to be careful that you do not injure the parts you have engraved.

The next thing will be to ink the cut, so that you can take an impression or "proof" of your work.

To make a dabber, take a large handful of loose wool, and tie it up in a stout piece of soft muslin; cover it with a piece of fine silk. Its shape should be circular, and large enough so that when tied it will make a convenient handle for the dabber. Wind this so that the ball part will be firm but yet elastic. Buckskin or kid may be used instead of silk, and the dabber may also be provided with a turned wooden handle.

A piece of thick glass, or small slab of fine stone, will afford a good surface for beating the ink fine. To take proofs you require the best quality of printer's ink; it should be that which is prepared purposely for taking proofs.

Put a small quantity on the slab, and, with the dabber, beat it very fine. After a few trials, you will be able to tell by the looks when it is beaten fine. When well beaten, proceed to ink the cut. Dab lightly, and let the dabber rest on the block a second or so, just long enough for the ink on the dabber to come off on the lines. Do not press the dabber down, or rub it over the cut, because in that way the ink will be smeared into the white spaces you have engraved. You want to ink the surface of the lines you have cut, and not get any ink into the spaces between.

After the block is properly inked, take a piece of India proof paper and lay it carefully on the surface of the cut. With an ivory paper cutter, rub over the whole surface of the picture, being careful, as far as possible, to rub in the direction the lines are cut. Hold the paper knife flat wise on the cut, and press gently, rubbing every part till the whole impression is made. If the paper is not too thick, you will soon see a faint impression through it. You must press very lightly on sharp and delicate lines, but may bear down on dark places, or those that are quite black. In this flower piece, you may use a moderate pressure on all parts except the petals. It is well to have your paper knife with one end in a blunt point, so that it can be used to press upon dark touches, as, for example, the centre spots of the flowers. But remember to keep the paper knife flat—do not use the edge, or you will bruise the lines you have cut. It is very easy to injure the delicate lines that make a wood engraving. A scratch or bruised spot will show in all the impressions made from the cut, so handle your cuts carefully. To keep your proofs, have a scrap book, and put into it proofs of all the cuts you make, in the order in which you engrave them; number them or date them, and you will thus have a record of your progress. Let each cut be made as carefully as if it was worth a great many dollars, and you will soon perceive that you make progress. But if you are careless, and do not take pains, you will never make a good engraver. The motto is applicable, "Make haste slowly."

If any of my young readers would like to ask any questions about anything we have gone over, I will answer them.

Learning to Use the Microscope—II.

HAVING provided objects for examination, the young microscopist is now ready to go to work. The light by which the examination is made may be either daylight or lamplight; good daylight is always to be preferred, but good lamplight is a great deal better than poor daylight, and it is not always that we can get good daylight. Where daylight is used, the light reflected from a white cloud or from a white wall is best; direct sunlight must never be used for ordinary work. At night any good lamp will do; what is known as the student lamp is undoubt-

edly the best. Considerable difference of opinion exists as to how the microscope should be placed in regard to the light, as, for example, whether it should be placed directly in front of the lamp or window, or to one side. To us it seems of little consequence, so long as the light falls full and fair upon the mirror, while the observer's eyes are completely shaded. A very simple arrangement of blackened paper or pasteboard will effect this, but if no such shade is at hand, the microscopist should sit with the lamp or window at his left hand, and his face directed to some comparatively dark part of the room.

The microscope being placed so that the light may fall on the mirror, the next step is to reflect a beam of light up through the microscope. The easiest way to do this is to place a transparent object on the stage, and turn the mirror until the beam of light falls squarely on it. Then look through the microscope, and if the field of view is not fully and equally illuminated, turn the mirror until by repeated trials this defect is removed. We are now ready to look at the object. It is supposed, of course, that the beginner has screwed on his *lowest* power; this is easily managed and will show a section of wood very well. Bring the objective down to within a quarter of an inch of the object, and while doing this do not look *through* the microscope, but watch the objective and the object from the outside. Then apply the eye to the eye-piece, and slowly move the body of the microscope, and with it, of course, the objective, upward, until the object is seen clearly and distinctly.

Before placing an object on the stage, see that the objective is raised at least half an inch above the stage, and when using high powers, never attempt to introduce a new slide without raising the objective; otherwise you run great risk of injuring both the object and the objective. This caution is peculiarly necessary, because in a little book that has been widely circulated directions the very reverse of these are given, and we are told to "1. Bring the objective down close to the stage. Do this before looking through the microscope. 2. Place on the stage the object to be examined." It would be impossible to suggest a better plan for breaking objectives and destroying slides.

These directions will enable the beginner to examine simple transparent objects, such as the eye, foot, tongue, etc., of a fly; sections of plants and of animal tissues, etc. Very many objects cannot be thus examined, however; the light cannot be made to pass *through* them, and they can be seen only by the light reflected from their surface. In this case it is almost always necessary to throw a very intense light upon the object, particularly if the object-glasses are not of the very best kind. To condense the light upon the object, a condensing lens is generally employed. The concave mirror, however, answers the same purpose, provided it can either be detached from the microscope and mounted on a separate stand, or raised above the stage, as is now arranged even in many of the cheaper forms of the compound instrument. To learn the use of the condensing lens or mirror, let the student arrange these in relation to the lamp so as to throw a bright spot of light on the object. In the case of the lens, the light passes through it, and is brought to a focus on the other side, just as a boy sets fire to an object by means of a burning glass. When the mirror is used, it is placed *beyond* the object, and the rays of light, after striking it, are reflected back again upon the object. In using either the mirror or the lens, it will be found necessary to place them at a proper distance from the lamp and from the object. If the lens be placed too near the lamp, the rays of the latter cannot be brought to a focus. It would be easy to give mathematical diagrams explaining this, but a few experiments will teach more than pages of writing.

— Certain manufacturers of a cheap microscope advertise it as follows: "It will show the tubular structure of hair; also the much-talked-of *trichina spiralis*, or pork-worm, which has caused so much excitement and so many deaths, thus furnishing an endless source of amusement and instruction combined"!!

Lessons in Magic—VI.

A Pretty Ring Trick.

FOR this trick, a handkerchief, a gold ring, a plate, a glass goblet, a thin light stick about eighteen inches long, and two assistants, are needed.

The goblet is placed on the plate, and each of the assistants requested to hold the latter by one hand. A ring is then borrowed, covered with the handkerchief, and given to one of the assistants to hold over the goblet.

He is then asked if he is certain that he has the ring, and on answering in the affirmative is told to drop it into the goblet, allowing the handkerchief to fall at the same time. With their disengaged hands, they are requested to take hold of the ends of the stick, which is placed horizontally under the plate. The performer begins the trick with the question,

"Are you sure the ring is in the goblet?"

"I think it is," the assistant will probably answer.

"Don't think about it, sir. Shake the goblet, and tell the audience whether you hear it rattle."

"Yes sir; quite distinctly," he answers.

The performer then approaches the goblet, and, taking hold of the handkerchief, bids the ring to "pass;" at the same moment, he raises the handkerchief, and the ring is seen revolving on the stick and the goblet is empty.

There is very little preparation required for this trick, the only thing necessary being to attach a ring to one end of a short thread, the other end of which is fastened to the centre of a handkerchief.

When the performer receives the ring, which he borrows, he pretends to cover it with the handkerchief, but instead of doing so, *palms* it, and gives the one that is attached to the handkerchief to the assistant to hold. The borrowed ring he slips on to the stick, and easily hides it with the hand that holds the stick. When it is laid under the plate, the handkerchief falls over it, and so prevents the audience from seeing it.

The one that is in the goblet is lifted out in the act of raising the handkerchief, care being taken that it does not strike against the sides of the glass.

When the trick is finished, the performer requests one of the assistants to help him with another trifling illusion. Having obtained his consent, he hands him the goblet used in the last trick, and asks,

"What is that article, sir?"

"A glass goblet."

"And what does it contain?"

"Nothing."

"Sir?"

"Nothing."

"SIR?"

"Nothing."

"SIR? Why it is full, sir; full of air. Do you know how that air may be displaced?"

"No, sir."

"By a very simple method. By merely filling the goblet to the brim."

And now commences

The Adventures of a Glass of Water.—The goblet is filled to the brim with water and placed on a table; the performer then covers it with a handkerchief, and taking it by the edge, offers it to the person who is assisting him. Just as he is about to take it, however, the performer shakes the handkerchief, and, lo! it is empty. He then asks the assistant if he can tell where it has gone, which, of course, he can not, unless he is a conjurer. The handkerchief is then spread out on the seat of a cane-bottomed chair, and to the astonishment of the audience, the performer lifts the goblet up from it as shown in the illustration (Fig. 7). The next moment, however, the handkerchief is thrown into the air, and is again empty. Finally it is spread out on his elbow, and once more, when Mr. Magician raises it, the form of the goblet is seen: the handkerchief is now removed, and the goblet is found to be still full of water.

To perform this trick, first get a wire ring made of the same circumference as the top of the goblet. This ring is laid to the centre of the handkerchief and stitched to it. When the goblet is to be covered, it is placed on the edge of the table at the back, and as the handkerchief is thrown over it, the performer takes hold of the bottom of it with his

left hand, and sets it on a shelf at the back of the table; at the same moment he takes hold of the ring with his right hand, and the handkerchief falling down, the

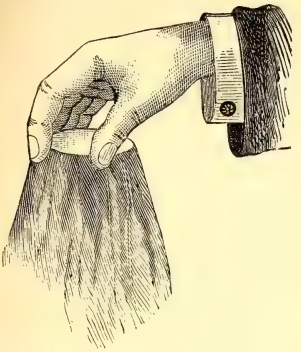


Fig. 7.

audience are not able to see whether the goblet is there or not, but from the shape will imagine that it is. When the handkerchief is shaken, the goblet seems to have disappeared, and when picked up by

Fig. 8.

the ring to have come again. In this way it can apparently be taken from any place.

To conclude the performance, the handkerchief is thrown over the left arm, which is held in the position shown in Fig. 8. The right hand is passed under the handkerchief, and takes from the inner left side pocket of the coat a goblet filled with water and covered with a piece of bladder. The bladder is moistened about the edges, and pressed against the sides of the glass, where it will tightly adhere. As the goblet is brought out from beneath the handkerchief by one hand, the fingers of the other hand clip (through the handkerchief) the edges of the bladder, and pull it off. The audience, this time, seeing the goblet filled with water, imagine that it was under the handkerchief each time that the shape of it was seen.

Editorial Notes.

Autographs.

WE have just received a small lot of very neat autograph albums, the regular price of which is 15 cents. We will send one of these albums, and also a copy of the "Amateur's Handbook," (price 15 cents), to any of our subscribers that will send us a new subscriber and fifty cents.

Postage Stamps.

SINCE the postal currency has been withdrawn from circulation, it is difficult to send fractions of a dollar by mail. We therefore announced that we would accept postage stamps at their full value for subscriptions. Some of our readers, however, seem to think that we *prefer* postage stamps; this is not the case, as we are in receipt of a much greater number of postage stamps than we can use, and consequently we have to dispose of them at a sacrifice. Hereafter we shall accept postage stamps only in amounts less than one dollar, and we would further say that stamps of large denominations are of no use to us; even three-cent stamps are a drug, but one and two-cent stamps we can always use. Canadian postage stamps are of no use to us. British postage stamps we receive at their full value.

The Heavens for April.

BY BERLIN H. WRIGHT.

PLANETS.—MERCURY will be invisible throughout the month.

VENUS will perceptibly increase in brilliancy this month, her apparent diameter increasing from 12″ to 13″.6—four times her increase in March. She will be 2¼° south of the Moon on the 24th, and will pass south of and very close to the Pleiades on the 15th. She is moving eastward past the stars, and until the 20th will be in the constellation Aries, and after that date in Taurus, being exactly midway between Betelguese and Auriga May 8. She sets as follows:

April 15—9h. 15m. evening.
" 25—9h. 38m. "
May 10—10h. 6m. "

The gibbocity of her phase will decrease as she recedes from the sun, and approaches her greatest eastern elongation, at which time one-half of her illuminated surface will be visible.

MARS will be about 3° south of the Moon on the 15th. He will be in the constellation Capricornus until the 24th, and after that date in Aquarius, rising as follows:

April 15—2h. 57m. morning.
" 20—2h. 47m. "
" 30—2h. 28m. "
May 10—2h. 7m. "

Mars and Jupiter will be less than one degree apart May 9, in the morning, Mars being the most southern.

JUPITER will be 4° south of the Moon on the 16th. He rises as follows:

April 15—3h. 31m. morning.
" 20—3h. 13m. "
" 30—2h. 38m. "
May 10—2h. 2m. "

SATELLITES OF JUPITER.—Satellite I completes a transit April 3, 4h. 58m. morn., and begins one, April 10, 4h. 39m. morn.; disappears in Jupiter's shadow April 25, 4h. 38m. morn., and reappears from behind the planet May 4, 4h. 32m. morn.

Satellite II disappears in Jupiter's shadow April 29, 3h. 45m. morning, and begins a transit across the planet's disc May 8, 3h. 3m. morning.

Satellite III reappears from behind the planet April 14, 2h. 29m. morning, and disappears in Jupiter's shadow April 28, 4h. 42m. morn.; reappears from an eclipse April 21, 4h. 14m. morn., and completes a transit May 2, 3h. 25m. morn.

All eclipses of Jupiter's Satellites must take place to the west of the planet at present, as his shadow is now thrown westward. At the time of the eclipse of Satellite II, above referred to, the Satellites will occupy the following positions with respect to Jupiter:

I, east, three times the apparent diameter of Jupiter.

II, west, half as far as I is east.

III, east, one and a half times as far as I.

IV, east, nearly five times as far as I, or at greatest distance. Hence, after the eclipse of II the three visible Satellites will be east of Jupiter. (For an inverting eye-piece reverse these directions).

SATURN is not favorably situated, rising as follows:

April 10—5h. 14m. morning.
" 20—4h. 37m. "
" 30—4h. 0m. "
May 10—3h. 23m. "

URANUS passes the meridian as follows:

April 15—8h. 35m. evening.
" 25—7h. 55m. "
May 10—6h. 56m. "

NEPTUNE will be in conjunction with the Sun April 30, and will be invisible for a long time before and after that date.

METEORS.—The following are the meteoric epochs for April: April 10—14; radiant in Virgo, April 20; period 27 years, *probably,* which would bring it in 1884, but as there is considerable uncertainty about the period, watch should be kept in the vicinity of its radiant—the Northern Crown: April 25, radiant near the head of Perseus, and April 30. Prof. Daniel Kirkwood, LL. D., finds that the orbit of the April 20 meteors and the first comet of 1861 are identical.

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS FOR APRIL 20, 1879.

	H.	*M.*
Alpha Andromadae (Alpheratz)	invisible.	
Beta Persei (Algol) sets	10	13 even.
Eta Tauri (Pleiades) sets	9	13 "
Alpha Tauri (Aldebaran) sets	9	31 "
Alpha Aurigae (Capella) sets	1	24 morn.
Beta Orionis (Rigel) sets	8	44 even.
Alpha Orionis (Betelguese) sets	10	18 "
Alpha Canis Majoris (Sirius) sets	9	45 "
Alpha Canis Minoris (Procyon) sets	11	56 "
Alpha Leonis (Regulus) in meridian	8	6 "
Alpha Virginis (Spica) rises	6	0 "
Alpha Bootes (Arcturus) in merid.	0	18 morn.
Alpha Lyrae (Vega) rises	7	43 even.
Alpha Aquilla (Altair) rises	11	19 "
Alpha Cygni (Deneb) rises	8	46 "
Alpha Pisces Australis (Fomnalhaut) rises	4	58 morn.
Alpha Scorpionis (Antares) rises	10	6 even.

VARIABLE STARS.—MIRA CETI is now invisible to the eye—7.0 magnitude, and slowly fading.

Beta PERSEI (Algol).—The following are the *visible* minima for April:

April 6—11h. 3m. evening.
" 9—7h. 52m. evening.

April 17—10h. 20m. evening.
" 20—7h. 10m. evening.

S Cancri.—*Minimum*—April 19, 10h. 57m. eve. This star has a period of 9.48 days, and changes from the 8th to 10.5th mag. To enable the amateur to find it we will give its place: Right ascension, 8h. 36m.; declination, 19° 30′ N.

Delta Libra.—Period 2d, 7h. 51.0m.; R. A., 14h. 53m.; dec., 7° 58′ S. Near the right foot of the Virgin. Changes from 4.5 to 6 magnitude. *Minima:*

April 3—5h. 44m. morning.
" 7—9h. 26m. evening.
" 10—5h. 17m. morning.
" 15—9h. 0m. evening.
" 17—4h. 51m. morning.
" 21—8h. 33m. evening.
" 24—4h. 25m. morning.
" 28—8h. 7m. evening.

LONG PERIOD VARIABLES.

Date.	*Star's Name.*	*Phase.*	*R. A.*	*Declination.*	*Period in Days.*	*Change of Magnitude.*
April 4.	*S* Ophiuchi.	maximum.	16h. 26m.	16° 53′ south.	229	3.3 to 13.5
" 7.	*R* Cygni.	maximum.	19h. 33m.	49° 54′ north.	416	8 to 14
" 8.	*R* Tauri.	maximum.	4h. 21m.	9° 52′ north.	327	8 to 13
" 14.	*T* Herculis.	minimum.	18h. 4m.	31° 0′ north.	160	7.9 to 13
" 15.	*R* Aquilae.	maximum.	19h. 0m.	8° 2′ north.	352	6.5 to (?)
" 19.	*U* Virginis.	minimum.	12h. 44m.	6° 16′ north.	212	7.5 to 12
" 19.	*R* Vulpeculae.	minimum.	20h. 59m.	23° 18′ north.	147	8 to 13.5
" 20.	*R* Andromedae.	maximum.	0h. 17m.	47° 51′ north.		6 to (?)
" 20.	*R* Virginis.	minimum.	12h. 32m.	7° 43′ north.	146	6.5 to 11
" 22.	*R* Sagittae.	minimum.	20h. 8m.	16° 20′ north.	70.88	8.3 to 10.3
" 30.	*R* Leonis.	minimum.	9h. 41m.	12° 2′ north.	312.57	5 to 11.5

U Coronae.—R. A., 15h. 13m.; dec. 31° 51′ N. Minima:

April 8—1h. 35m. morning.
" 14—11h. 17m. evening.
" 21—8h. 59m. "

Penn Yan, N. Y.

Use of Sandpaper.

It would seem as if sandpapering were one of the easiest and simplest matters, and yet there are few things connected with this art that are so little understood. The ordinary way with the novice is to tear off a piece of sandpaper, hold it with his fingers, and rub the wood with it. This method is very likely to lead to bad results. If it is a piece of open work that needs smoothing, the paper takes off too much wood at the edges, and rounds them off. Or, if it is a flat piece of wood, the fingers bear on harder in some places than others, and make the surface uneven.

Now, there are two ways to sandpaper nicely. If the piece of work is small, fasten a whole sheet of sandpaper to your bench or a flat, smooth board, and rub the wood over it. This is the best method for all small articles. For general purposes, however, it is best to make a sand-board, which is done in this way: Cut two pieces of smooth pine, three-eighths of an inch thick, three inches wide and four long; through one of them put three slender screws in a line and one and one-half inches apart, long enough when the heads are driven in flush with the wood to have the points project about one-fourth inch on the other side. File these points sharp, and make corresponding holes in the other block. Now cut a piece of sandpaper four inches wide and seven and one-half long, and lay one end upon the screw points, pressing them through the paper. Then stretch the paper tightly around the block, and fasten the other end upon the points. Lay upon this the other block, and fasten the two together with a screw at each end. A pair of common screw-eyes that are used for hanging picture frames will be useful for this purpose. It would be well to have two sets of these blocks made to hold coarse and fine sandpaper. Now lay the work upon the bench, hold it with one hand, and rub with the sand-board, carefully and briskly, and with a circular motion. If the wood is at all rough, begin with No. 1 sandpaper, and finish with No. 00. Before using the paper on any fine work, examine it carefully, and pick out any large pieces of sand which might score the wood.

If the amateur is fortunate enough to possess a turning lathe, he will find that the following contrivance will save him a great deal of labor: Make (or have them made by some turner) several cylinders of wood, four inches long and three and one-half in diameter. Stretch around one of these a half sheet of sandpaper, and glue the two ends to the wood. Set this in the lathe, revolve rapidly, and it will smooth the wood very quickly. The writer uses half a dozen of these cylinders, with a different number of sandpaper on each.—*Arthur Hope.*

Cork Stamps.

A great many business houses make use of rubber stamps, which are manufactured in large quantities and sold at a good profit, the business being comparatively new. The stamps are made by setting up the desired words in common type, precisely as for printing. A matrix is then obtained by covering the face of the type with moistened plaster of paris, which is allowed to remain until "set," after which this reverse impression is filled with the prepared rubber. When the rubber filling is taken from the plaster mold, it is a perfect fac simile of the type from which the cast was taken, and after being mounted on a convenient handle, is used for printing as a hand-stamp.

A good substitute may be made in cork by cutting the letters with a sharp penknife on the end of a smooth bottle cork, of sufficient size to hold the words intended to be printed—of course cutting the letters and spelling the words backwards, that the impression may appear properly. Our young readers will find this an instructive amusement, and many short words and sentences, such as "PAID," "ACCEPTED," "ANSWERED," "RECEIVED PAYMENT," "P. O. BOX," etc., would prove acceptable to a father or a brother, for use on the office desk.

The same ink is used as for rubber stamps, and may be procured at most stationers. One drop on a piece of flannel is sufficient, and will remain moist a long time. The cover of a wooden pill-box makes a good receptacle for the ink pad, and with this the outfit is complete.

To Straighten Warped Woods.

Of all the trials and vexations that beset the beginner, there are none more annoying than the tendency of wood to warp. He sends to his dealer for a small assortment of fine woods, and expects to receive them perfectly true and flat. Perhaps the woods are flat when they leave the dealer, but in transit they are very likely to twist out of shape, reaching their destination badly warped. The expressman may not be aware of the subtile nature of these woods, and in not a very gentle manner lays the package on a damp, cold floor. The dry wood sucks in the moisture on one side, swells and curls. It should not be a difficult matter to cure this. If the wood is in a large piece, the convex or hollow side should be steamed or moistened a little, and then laid upon a dry floor, holding it down with a smooth, flat board, upon which weights are placed. When quite dry, it will be found to have regained its original shape. If the wood is in small pieces, it can be easily straightened by gently steaming the convexed side over a tea-kettle, and then holding the other side towards the heat until it becomes straight, when it can be left in a press or under weights for a few hours. Almost any warped woods will yield under this treatment.—*Leffels' News.*

BOOK NOTICES.

Rhymes of Science—Wise and Otherwise: Containing Poems by O. W. Holmes, Bret Harte, R. W. Raymond, J. W. McQ. Rankine, and others. New York: Industrial Publication Company.

In addition to several familiar pieces by well-known authors, such as the "De Sauty" of Holmes, the "Pliocene Skull," and the "Society upon the Stanislaus," by Bret Harte, this little volume contains a large number of fugitive pieces which seem never to have found a place except in the pages of some periodical. Some of these are very good—as witness the new version of "I'd be a Butterfly," and the "Tail of Long Ago," by some unknown author.

The book cannot fail to afford a good deal of amusement. Scientific men will appreciate it for the burlesque which it gives of many points in science, and others will relish it for its fun alone.

Practical Hints.

Imitation Mahogany.—Brush over the wood with common ink; when that is dry, brush it over with dragon's blood mixed with methylated spirit in the proportion of one ounce dragon's blood to one-half pint of the methylated spirit. When that is dry, varnish with spirit varnish.

Indestructible Ink.—The Boston *Journal of Chemistry* gives the following directions for preparing an indestructible writing ink: An ink that cannot be erased with acids is obtained by the following recipe: To good gall ink add a strong solution of fine soluble Prussian blue in distilled water. This addition makes the ink, which was previously proof against alkalies, equally proof against acids, and forms a writing fluid which cannot be erased without destroying the paper. The ink writes greenish blue, but afterwards turns black.

Tanning Sheepskins with the Wool On.—Sheepskins and the hides of some dogs make excellent mats, rugs, etc. The following process has been found to succeed very well: Tack the skin upon a board with the flesh side out, and then scrape with a blunt knife; next rub it over hard with pulverized chalk, until it will absorb no more. Then take the skin off from the board and cover it with pulverized alum; double half-way over, with the flesh side in contact; then roll tight together and keep dry for three days, after which unfold and stretch it again on a board or floor, and dry in the air, and it will be ready for use.

How to Kill Entomological Specimens.—A correspondent says the method of killing entomological specimens, by putting them in a glass cylinder closed at one end, and then inserting a wad of tow saturated with ether on closing the other end of the cylinder, is very good; but when putting the insect, especially butterflies, in the tube, it flutters its wings, and so loosens some of the colors. A better way is to put a small bit of chloroform on the insect's head as soon as it is caught, and the effect is that it instantaneously dies, not even a relaxation of the muscles being perceptible.

Liquid Slating for Blackboards.—Alcohol, (95 per cent). 4 pints; shellac, 8 ounces; lampblack, 12 drachms; ultramarine blue, 20 drachms; powdered rotten stone, 4 ounces; powdered pumice stone, 6 ounces. First dissolve the shellac in the alcohol, then add the other ingredients, finely powdered, and shake well. To apply the slating, have the surface of the board smooth and perfectly free from grease. Shake well the bottle containing the preparation, pour out a small quantity only on a dish, and apply it with a new flat varnish brush as rapidly as possible. Keep the bottle well corked, and shake it up every time before pouring out the liquid.

Depositing Brass by Electricity.—Herr Hess, in the *Metallarbeiter*, gives the following directions for this process: The first step is to thoroughly cleanse the articles, either by means of emery, or by laying them overnight in a weak bath of sulphuric acid. They are then washed off with water, a weak soda solution, and then immersed as the cathode of a bath consisting of 2½ parts of sulphate of copper, 20 parts sulphate of zinc, and 45 parts cyanide of potassium, in 300 parts of water. The anode should be two plates of zinc and copper of equal size. The color of the resulting brass coating may be modified by varying the depth of immersion of one or the other of the plates. The galvanic current should be a strong one, and the liberation of hydrogen bubbles on the object to be brassed should be plentiful. It is important, however, to note that the objects should be first coppered to insure a strong attachment of the brass coating.

Stimulating Progress among Young Mechanics.—Honorable competition in actual work is a great incitement to progress. This, we think, is well applied by an English society of turners. The subjects of competition were: turning in ivory, pottery, stone and jet; and steel, brass and gold for horological purposes. The competition in ivory included vegetable ivory. The qualities considered in awarding the prizes were: Beauty of design, symmetry of shape, utility, and general excellence of workmanship; exact copying, so that two objects produced should be fac similes in every part, or exact measures of capacity: fitness of the work or design for the purpose proposed; ability to turn, whether circular or oval; and novelty in application of turning or in design. Carving was admissable, but it was to be subsidiary to the turning. The candidate was to make his own selection from the above conditions; but the one who best fulfilled the largest number, including the most important qualities, was preferred. The work to be all hand-turning, produced in the lathe, without special rest or tool apparatus, and the carving to be the work of the exhibitor.

Fitting Glass Stoppers.—Very few stoppers fit properly the bottles for which they are intended. The stoppers and bottles are ground with copper cones, fed with sand and made to revolve rapidly in a lathe, and the common stock are not specially fitted. To fit a stopper to a bottle that has not been ground, use emery or coarse sand kept constantly wet with water, and replaced with fresh as fast as it is reduced to powder. When all the surface has become equally rough, it is considered a sign that the glass has been ground to the proper shape, as until that time the projecting parts only show traces of erosion. This is the longest and hardest part of the work, as after that the glass simply needs finishing and polishing. For that purpose emery only can be used, owing to the fact that the material can be obtained of any degree of fineness, in this respect differing from sand. Otherwise the operation is the same as before, the emery being always kept moistened, and replaced when worn out. The grinding is continued until both the neck of the bottle and the stopper acquire a uniform finish, of a moderate degree of smoothness, and until the stopper fits so accurately that no shake can be felt in it, even though it be not twisted in tightly.

Uranine.—This is the most recently discovered, and perhaps the most remarkable, of all the coal tar or aniline group of coloring substances, now so extensively used for the adornment of the finest fabrics. Uranine is said, by chemists, to be the most highly fluorescent body known to science. Its coloring power is astonishing; a single grain will impart a marked color to nearly five hundred gallons of water.

A most interesting experiment, which anybody may try, consists in sprinkling a few atoms of uranine upon the surface of water in a glass tumbler. Each atom immediately sends down through the water what appears to be a bright green rootlet, and the tumbler soon looks as if it were crowded full of beautiful plants. The rootlets now begin to enlarge, spread and combine, until we have a mass of soft green-colored liquid. Viewed by transmitted light, the color changes to a bright golden or amber hue; while a combination of green and gold will be realized, according to the position in which the glass is held. For day or evening experiment, nothing can be prettier than these trials of uranine, which are especially entertaining for the young folks. We are indebted for examples of the color to the editors of the *Scientific American*, who are sending out specimens, free of charge, to all their readers.

EXCHANGES.

Yearly subscribers to the Young Scientist have the privilege of inserting three exchanges (or one exchange three times) during the year. This privilege is strictly confined to *exchanges; buying and selling* must be carried on in the advertising columns, where the charge is 30 cents per line. Each exchange is limited to thirty words, making about four lines, and in order to receive attention must be written on a slip of paper by itself. We file all letters received, and have no time for copying out exchanges and queries.

As we desire to make the journal of the utmost value to *all*, and not merely to serve the interests of individuals, we shall strictly adhere to these rules, which are certainly liberal, giving as they do advertising to the value of $3.60 free to each subscriber.

Wanted, a collection of Southern woods, for a collection of New Hampshire woods; will exchange for rough pieces. W. P. Adams, Pittsfield, N. H.

For exchange, a guitar, patent head, nearly new, cost with strings $14—splendid instrument, in good order; state what you have to exchange. W. Z. Allen, Monrovia, Ind.

A No. 1 self-inking Official press, costing $10, and $13 worth of type and fixtures, to exchange for a combined bracket saw and lathe, or offers. C. A. Bacon, Elba, Lapeer County, Mich.

To exchange, Bourne's "Treatise on the Steam Engine," cost $5, for chemical apparatus and chemicals of the same value. E. T. Birdsall, 39 East 22d street, New York.

Wanted, 350 or 400 different kinds of foreign stamps; state what is wanted in exchange. John S. Briggs, Newark, N. Y.

Wanted, January and March (1878) Nos. of Young Scientist in exchange for the "Mineralogist Companion." Walter Brockstedt, 2118 Carondelet Avenue, St. Louis, Mo.

Printing press, cost $35, and several fonts of type, in exchange for anything pertaining to science, literature or art. E. S. Dayton, Basking Ridge, N. J.

To exchange, one telegraphic key and sounder, in good shape; also a new scroll saw; state offers. John Duff, Jr., Pontiac, Ill.

Two Bunsen batteries to exchange for engraver's tools, or Vols. 1 and 2 of Scott's "Coin Journal," or old U. S. coins. Clark Horn, Jr., Box 582, Scranton, Pa.

An oscillating steam engine, 1-inch bore, 2-inch stroke, for a Queen's Household microscope, or offers. L. Kent, Santa Anna, Los Angeles Co., Cal.

Wanted, in exchange for valuable books (of which lists will be sent on application), Packard's "Guide to the Study of Insects," edition of 1876. C. H. L., 57 North 1st street, Edgefield, Tenn.

To exchange, cocoons of Attacus Luna, Cecropia and Polyphemus, for specimens of entomology or geology. Geo. A. Lippincott, Box 50, Watsontown, Northumberland Co., Pa.

A new stationary steam engine of ½-horse power, worth $30, in exchange for a good watch, or almost anything; mention offers. H. Mackenzie, Jr., Petroila, Ontario, Canada.

To exchange, complete set drawing instruments, cost $3; state offers. J. Mueller, 2453 Kosciusko street, St. Louis, Mo.

In exchange for books, a Novelty printing press in excellent condition, prints a form 6½x10½ ins.; cost $32, ink roller cost 75c., and $1.50 worth blue ink. J. A. Osborn, Scientist, Mahmal, Cambridgeport, Mass.

To exchange, a Novelty printing press, type and accessories, for a microscope with accessories, or minerals, or offers. T. W. Patterson, Warsaw, N. Y.

Will exchange one or more of my new extension step fruit ladders, the "Climax," price $2.50, for merchandise. H. E. Phelps, Marshall, Mich.

Wanted, an achromatic photo camera, a good shotgun, or scientific books or apparatus, in exchange for a fine scroll saw in good condition. A. B. Porter, 501 N. Tenn St., Indianapolis, Ind.

"The History of Our Country," by Benson J. Lossing, cost $15; also other books to exchange for scientific and practical books and apparatus. H. M. Rauschkolb, 246 Delord St., New Orleans, La.

Telegraphic key and sounder, finely wrought on proper base, cost $8; will exchange for good revolver. S. G. Reese, Box 133, Elizabethtown, Lanc. Co., Pa.

To exchange, one set of Lily carving tools of three pieces; state what is offered in exchange. B. M. Rockwood, Franklin, Mass.

Wanted, a first-class work on entomology, with colored plates, for Stanley's Travels, calf bound, nearly new; also other books and minerals to exchange. H. Salisbury, Box 399, Whitewater, Wis.

Wanted, a coachmaker's vice, opening 8 or 9 in., in good order, or a lot of thumb screws, in exchange for an E-flat cornet worth $15, or violin worth $12. B. H. Smith, New York Mills, Oneida County, N. Y.

Wanted, a Seltz's boys' theatre; state what is wanted in exchange, and give full particulars of the style of theatre. H. C. Spaulding, 7 Princeton street, Boston, Mass.

Kane's Arctic Explorations, for a small printing press with type and ink. H. B. Taylor, Tehuacana, Limestone Co., Texas.

A game of parlor billiards, cost $4, will be given in exchange for something of equal value. J. H. White, Canajoharie, N. Y.

Back numbers of "Youth's Companion," for the years 1877 and 1878, in good condition, to exchange for chemicals, chemical apparatus, or offers. F. Willis, 3 Myrtle street, Boston, Mass.

THE

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KNOWLEDGE IS POWER.

INDUSTRIAL PUBLICAT[ION]

A PRACTICAL JOURNAL FOR AMATEURS.

VOL. II. NEW YORK, MAY, 1879. No. 5.

Scroll Sawing—I.

BY F. T. HODGSON.

OF course, every boy, and a great many girls that we know, would like to own a good scroll saw; and this desire is a laudable one, and we know of no reason why it should not be gratified, for a knowledge of the use of the saw and its employment has a tendency to awaken and develop any artistic talent that might otherwise have remained dormant in the youthful operator. It is also a source of amusement, affording as it does a pleasant pastime for all who take an interest in the work; it can at the same time be made profitable, as many of the beautiful articles that can be produced sell readily at remunerative prices.

It is true that many boys and girls cannot afford to buy the more expensive saws; but they should not be discouraged on that account, for if they are unable to procure a foot machine, they should try and get a "hand" or frame saw, such as we show in Fig. 1, which, if made of beech or other native wood, can be obtained for about seventy-five cents.

In using this saw, at first, it will be found very difficult to control, but by a little perseverance, it will become tractable enough, and when once the mastery is obtained, you will have arrived at a point of excellence that is scarcely ever reached by the person who has never used a hand sawing-frame.

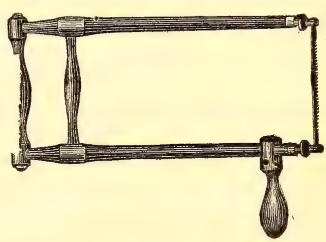


Fig. 1.

There are many kinds of frames for saws, each kind possessing some special quality of its own, but the simplest we ever saw was made with a single piece of ash, about ten inches long, and probably three-eighths of an inch in diameter; a slot, or groove, was cut in each end with a fine saw—it was then bent over like a bow,

and the fret saw, which had previously been heated at the ends and turned over, was inserted in the grooves, and the tension on the bow kept the saw taut. This little device did excellent work, and was easily adjusted, as the saw could be instantly removed by simply bending the bow.

Fig. 2 will convey an idea as to how the saw was formed. It will be seen that the fret saw forms the string, as it were, of an

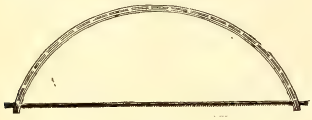


Fig. 2.

ordinary bow. A little ingenuity displayed in this direction, and the expenditure of a few cents for saws, will enable any boy to make a saw frame like the one just described, and when once in possession of a saw capable of doing good work, it will not be saying much for the owner's intelligence and industry, if he does not soon make it earn money enough to purchase a good foot-power machine.

Fig. 3 shows another style of a *home-made* saw frame, which can be constructed at small cost by any one who can use carpenter's tools. The jaws, *o o*, are made of

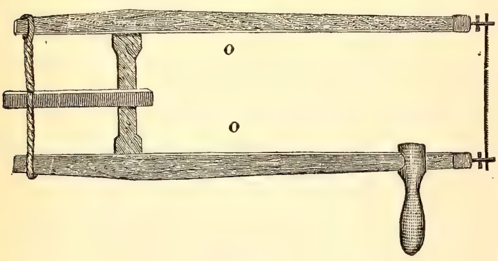


Fig. 3.

dry, straight-grained beech or maple, and are about twenty inches in length, and one inch square. They require to be made tapering toward the ends, as shown in the drawing, the ends near the saw being finished to about half an inch square, and the other end finishing up to about three-quarters of an inch square. At the point where the stretcher is mortised into the jaws, the latter should be left the full size of the wood, for it is there where the greatest strain exists, and the jaws will be weakened somewhat by the mortises being made in them. The jaws should be rounded off or chamfered a little to the outside of the frame from end to end, as it makes the frame look so much neater and workmanlike.

The next thing will be to make the stretcher, which should be about nine inches long and one inch square. A piece of straight-grained pine is good enough for this purpose, as it has not much strain to resist. Cut tenons on each end, as shown in Fig. 4, about half an inch long, and three-eighths of an inch thick. Cut

Fig. 4.

out the sides with a spokeshave, same as shown, then mortise the jaws, to receive the tenons on the stretcher, about five inches from the tail ends, and see that the tenons fit nice and snug, but not too tight. It is very important that this part of the work should be well done, for if there is any lost motion crosswise of the saw, it will be very difficult to make it cut straight.

Notch the jaws at the tail ends on the outside edges, to receive a cord, as shown at *s*, in Fig. 3. The use of the cord is easily understood; the slat of wood that runs through it is about three-quarters of an inch wide, and about one-quarter of an inch thick. In tightening up the cord, the slat will require to be pushed up until there is room enough for it to pass the stretcher, when the saw can be made taut, after which the slat can be slipped down until it assumes the position shown in Fig. 3.

The next thing will be to make a neat handle, which can be done as follows: Take a piece of good tough wood, about one and a quarter inches by one inch, and six inches long; bore a straight hole, half an inch in diameter near one end and through the flat side; fit it to one of the

jaws, as shown, then work it off something like the shape shown in Fig. 5. This handle may be fastened to the jaw by a small screw or a little wedge or key, which

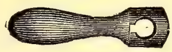


Fig. 5.

may fit into a slot left in the handle, as shown.

On the saw ends of the jaws it is desirable to have ferrules made of tin, copper, or brass, nicely fitted on, as they prevent them from splitting when the clamps are screwed in. These ferrules, or thimbles, can be obtained in any hardware store; if not, a couple of common thimbles, filed down and nicely fitted on, make excellent substitutes.

For a clamp to hold the saw, we know of nothing in the market so cheap and efficient as the one shown in Fig. 6, which can be obtained from most hardware stores for about twenty or twenty-five cents a pair. The shank on each one is

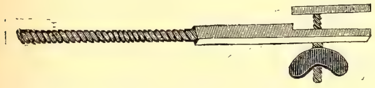


Fig. 6.

from one and three-quarters to two inches in length, and has a thread cut on one end for about an inch in length, the other end having a thumb-nut and screw, as shown. Great care must be taken to get these clamps in straight and true, and to prevent the ends of the jaws from splitting.

When the clamps are in place, the handle on, the saw made fast, and the cord tightened up, the work is nearly completed; all that is then to be done is to sandpaper the whole work, and give it two or three coats of raw linseed oil, rub in, then wipe off surplus oil with a clean cloth, and you will have a saw complete in every particular, for the small sum of forty cents. You will also have received a lesson in practical mechanics that is worth more to any boy than the value of a dozen saw frames,

Drawing Lessons—II.

BY JOHN CLARK CENTER.

NOW that you understand the difference between perpendicular, horizontal, and oblique lines, let us turn our attention to angles and their peculiar relations to some standard of measurement.

Right angles are easily recognized when we have to deal with perpendicular and horizontal lines; but if they should be

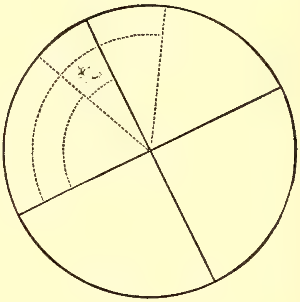


Fig. 1.

placed in an oblique position their character is not so obvious. A right angle is contained between any two lines proceeding from the centre of a circle, which include one-fourth part of the circumference or ninety degrees. If even a single degree less than this it becomes an acute angle, and if larger than ninety degrees it is an obtuse angle. To impress on the mind the

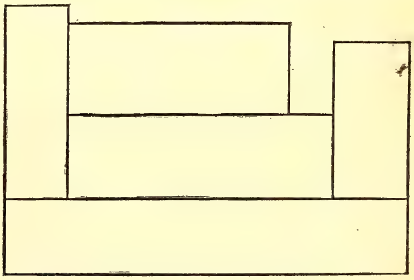


Fig. 2.

appearances of these angles in different positions, the student should devote some time to drawing them and studying their relations.

A square is a figure circumscribed by

four lines of equal length, united to each other at right angles.

A parallelogram is composed of four straight lines, the opposite sides being parallel and equal; but the adjacent sides may be unequal. Place several of these in conjunction and study their positions, etc. (Fig. 2).

A superficies is a surface of any form.

A cube is a solid body having six equal square sides, and all its angles right angles. A model of one should be procured by the student; as the laws of perspective can be simplified by observing the different angles produced by every change of its position in relation to the eye.

The cube being placed before the eye will illustrate this perfectly, as the top and sides, although square, do not appear to be so, and the purpose of drawing is to represent objects as they are seen. In the cube (Fig. 3), the top, which in nature is square, is represented by a figure narrower than it is long, and with two acute and two obtuse angles.

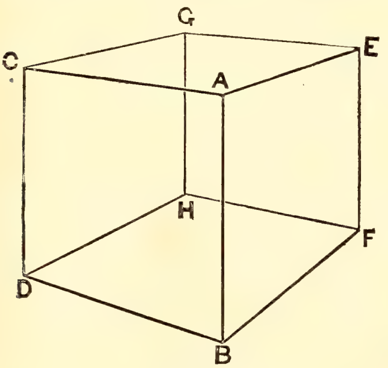


Fig. 3.

Lines converge when they are inclined toward each other, and if extended in this direction they will meet at some point. To prove the form that a square assumes, place the image of one in a perpendicular position with one end retreating from the eye—the end removed will appear shorter, and in the horizontal will appear to converge to some point.

Let us construct a cube with these ideas distinctly before us, and without the actual knowledge of perspective we can train the hand and the eye to do much.

Fix the perpendicular A B, of any length, and as the eye is to look down on the cube, draw C A, foreshortened, or less than A B, which is the only line seen of its real length. Next draw C D shorter than A B, (but longer than C A), because it is more distant; again join D B. Here we have the square A, B, D, C in perspective. Now determine the slope of A E, which being more foreshortened than C A, will slope more and be shorter. Again, E F being more distant than C D, will also be shorter. Join B F. Fix on the point G, so that G E shall be shorter than C A, and G C shorter than A E, being more distant: then the line G H being most distant, will be the shortest perpendicular, and joined with D and F, we will have the figure complete.

We will now observe that the figure A, C, G, E, the top of the cube, is narrower than B, D, H, F the base, because it is more on a level with the eye, and we see less of its natural form. Thus we have now learned that although lines are of equal length in nature, in drawing they should be made smaller according to their distance. Angles are also modified and obey a similar law. This important exercise should be practiced by an indefinite number of examples, changing the position of the cube in relation to the eye; for the diagrams so constructed are the bases on which we fill in the varied forms from nature.

In the construction of a diagram for practical purposes, we must be able to divide and subdivide its sides into proportionate parts. Take the following example (Fig. 4). In drawing a building we construct the side A, B, D, C, then A, B, F, E. Now if we want to divide either of these sides into any given number of equal parts, divide A B, and C, D, into the given number, join the corresponding points, and draw a diagonal from A to D. The points of intersection will give the positions for the perpendicular and proportionate divisions. In these may be described arches or windows in perspective.

By a well grounded practice in exercises which almost any object may suggest, the

student will have laid a groundwork for understanding the more complicated lessons that will treat on perspective, which when presented to the unprepared mind are an obstacle that puzzles and confuses, and is very little understood by many an

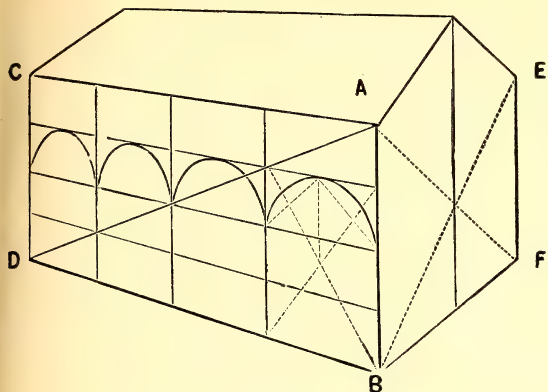


Fig. 4.

accomplished artist, who depends more on manipulation and natural instinct than upon complicated methods.

It will be found that by placing a number of books on the table and studying

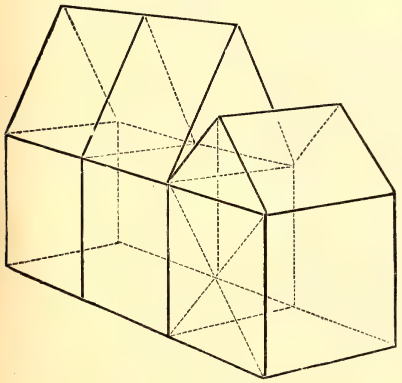


Fig. 5.

their relative positions, good examples can be easily had; other objects may be added of a more complicated form.

The examples shown in Fig. 5 are suggestive of arrangements and changes in position, of which it is so important to have experimental knowledge. All this must be learned by practice and industry, from which alone comes skill.

Home-made Hanging Basket.

BY A. W. ROBERTS.

THE variety of materials which may be applied to the construction and ornamentation of hanging baskets is almost infinite. Amongst others, shells and corals, and "sea mosses," afford material for constructing unique and pretty baskets, an example of which is shown in the engraving (Fig. 3). The foundation consists of a common earthen flower-pot which was first warmed in an oven, and then coated thickly on the outside with asphalt cement.

Around the rim of the pot are fastened fan-shaped masses of "branch" coral, great care having been taken to cement them firmly. A mass of coral is also fastened to the bottom of the pot, as shown in the cut. Around the centre of the pot is fastened a band of scallop shells of brightest colors. The coating of black

Fig. 1.

asphalt and the pure white of the coral, gives the pot a half-mourning look, which is broken up by coating it with algæ (sea weeds). Fifteen cents worth of Irish moss (*Chondrus crispus*) was purchased, and some *Sertularia argentia* obtained from Coney Island. These were made into small bunches, the ends of which were dipped into hot asphalt till a knob was

formed as in Figs. 1 and 2. These were stuck all over the asphalt and about the base of the coral wherever the asphalt was exposed.

Those who do not live near the sea

Fig. 2.

shore, where shells and sea weeds can be obtained, but who can procure the coral or have it on hand, should not think of using it and covering the asphalt coating with wood mosses and the burrs and cones of the woods, as no combination can be so out of place, out of keeping, and offensive to good taste, as sea shells and corals brought in conjunction with wood mosses and cones. These window ornaments at best would be condemned by a person of severe æsthetic tastes, but there is no excuse for deliberately burlesquing nature by having a mass of coral from the East Indies starting out from a bed of lichens from Maine.

You must follow the order and harmony of nature. For instance, take branches of the liquid amber (which in form and habit is very suggestive of coral) as a substitute for the coral; for the seaweeds use wood mosses and lichens; for the band of scallop shells, use a band of dried and pressed oak leaves, with acorns fastened on here and there. In this way you will obtain the rich grays, browns, and greens of the woods. If you have any preserved butterflies or beetles, by all means fasten on a few of them, but don't plaster all over with bugs. Don't torture nature like a barber I know of, whose place I carefully avoid, who decorates (as he thinks) his windows with sweet potatoes, turnips, beets, and carrots, scooped out, filled with water, and suspended upside down. The

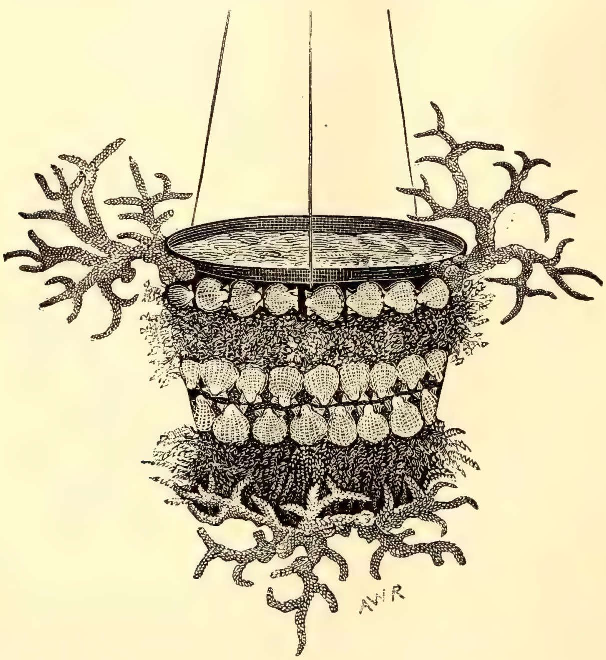


Fig. 3.

poor things produce sickly and abortive leaves, till they drop down, a decaying mass. And this wretched barber thinks this all wonderful and beautiful. I pray that the young readers of this journal will never be guilty of torturing such honest vegetables and good taste in this *barberous* way. But fix up your window as I have mine, and the ladies from far and near will exclaim, "Oh! isn't it perfectly beautiful."

The Hunted Fisherman.

BY A. W. ROBERTS.

I HAD now turned my attention to collecting fish and other aquatic animals, as well as plants. A small nest-building fish known as the three-spined stickle-back being in great demand, and selling as high as twenty-five cents a pair for breeders in good color, I determined to secure a good quantity of them from a pond situated a mile from the old homestead in Williamsburg, N. Y.

This pond occupied the same ground on Broadway where now stands the German Savings Bank, and Tuttle's coal yard, and was fed by a small stream that flowed in from Wallabout Bay through Johnston's woods, causing the water to be brackish. Up this stream the stickle-backs ascended every spring from the salt water of the bay to the fresh water to breed. When Broadway was laid out and graded, the stickle-backs became land-locked, and dwarfed in size, but, most strange of all, took to building their nests in communities, one male fish often attending many nests.

These fish were very shy, and, on the approach of any one, would retreat to deep water, where the hand net was of no use; so I constructed a small seine of mosquito netting, using bottle corks for the "cork line," and bits of lead pipe for the "lead line." For the "warp lines" I used two clothes lines; the "staffs" consisted of turned pickets.

The night I had set for trying the seine was cloudy, with now and then a bit of moonshine breaking through. Just the kind of night I desired, as the stickle-backs would not be so easily alarmed. So at one o'clock in the morning I might have been seen climbing out of my bed-room window to the roof of the kitchen, whence I reached the garden by a ladder previously placed in position.

Dressed in a suit of old garden clothes and shoes, and provided with two pails and the seine, I felt confident of securing at least one hundred and fifty before returning home, which would yield me $3.50; not a bad night's work for a youngster.

Reaching the pond at two o'clock, I felt safe from all intrusion and questionings from curious passers by, and possible discovery by other collectors, whom I had often noticed following me. This pond lay in the beat of a certain policeman, a very ugly, cross fellow, who was particularly "down" on all small boys, who, in lieu of a better name, christened him "Tight Lips." His beat being a very long one, I was in hopes that he would not come my way before I was through, or that he would take a nap in one of the engine houses.

The houses near the pond were few and far between; not a light was to be seen nor a sound to be heard, except the occasional croaking of a frog. I determined to make my first haul near the upper end of the pond, in the centre of which projected a large post. From this post I intended to work one end of the seine in shore again. Tying the end of one of the warp lines to a stone, I took off all my clothes preparatory to swimming out to the projecting post. I could not wade out, for the reason that at the bottom of the pond were numerous broken glass bottles, and years before this place became a pond, there was a brick kiln which had left deep pits, where the water now stood ten and fifteen feet deep.

So placing my shoes and clothing in the pails, I slid gently into the water, holding on to the end of the warp line with my teeth. I had but just reached the post, when I heard a policeman's club rattling a playful sort of tattoo against the numerous large rocks that bordered the foot-path of the road. In an instant I was all under water but my head, and that was securely hidden behind the post. I now waited breathlessly for him (it was "Tight Lips") to pass on, hoping that he might not observe my clothing standing on the bank; but just as he was about to

pass the spot, out burst the moon, flooding the pond and shore with light. In a moment he was busy examining my clothes by the light of the moon, evidently much puzzled. Fearing that his next move would be to secure the "warp line" of my seine, I began pulling hard and steady on my end, hoping that the line would slip off the stone easily and without noise, but alas! as I pulled I could see the stone sliding slowly and noiselessly toward the water, in its course upsetting one of the pails, and carrying the other with it. In moving the pails he must have placed them directly on the line. When "Tight Lips" saw this, he started for the top of the bank, frightened. Fortunately the "cork line" was well under water, as the seine hung in the very deepest part of the pond. Now, taking a rest, I determined to retain my present position till he walked away, but he wouldn't walk; he deliberately sat down on one of my pails to wait for further developments. In this position we remained for half an hour, he watching the pond and I watching him. It was evident he had not discovered my hiding place nor the seine. Soon he got up, and examining my clothes again, went through all the pockets, even closely scrutinizing my handkerchief in search of a name. The moon passing out of sight again, I pulled in the seine vigorously till it was all in by the post. By this time, feeling chilly and cramped from being in the water so long a time, and in one position, not to mention the stings of boat flies, and ravenous nippings of horse leeches that swarmed about me, I determined to sink the seine with stones, of which there were plenty, around the post under the water. So treading the net down to the bottom of the pond, I silently sank myself under the water to where the stones lay, placing them securely all over the net to keep it down. Making a calculation as to the value of my things on shore, I concluded to sacrifice them rather than be taken to the station house undressed, or to my father's, at that hour of the night, to be laughed at by my brothers the next day.

Some forty feet from where I stood projected forth a long dark shadow cast by a tall factory situated on the opposite shore of the pond to where policeman sat. If I could reach that shadow unobserved, I would be all safe. So inflating my lungs to their fullest capacity, I settled down to the bottom of the pond, and struck out vigorously under water in the direction of the friendly shadow. Knowing by the change of light that I had entered it, I rose to the surface, taking great care to keep my face turned away from where the policeman sat, and not to puff too loud in allowing the escape of exhausted air from my lungs. Now remaining perfectly motionless for a few minutes, and working the corner of one eye round, I obtained a peep at the reclining policeman. He still remained just as I had left him before I went under. I now ventured to move ahead, going very slowly. I was doing nicely, when whop! came a big stone right near my head. It was evident he had discovered me; my only chance was to gain the shore as quickly as possible. As the pond occupied an entire block, he would have to run around it before he could reach me. The stones fell thicker and faster. He called to me "To come out or he would take me in." I answered back that I could'nt get out any faster. In a minute more I had reached the shore and was dashing up Lorimer street at full speed for home, then down Remsen street, he following close behind. Reaching the "corn lot," over the high fence I vaulted, then through the tall corn, across the garden, over the kitchen roof by the ladder (which I drew up after me) and into bed, feeling that I had had all I desired of "fish hunting" for one night.

To be continued.

Lessons in Magic—VII.

The Flying Watch.

"WILL some lady be kind enough to lend me a white kid glove?" the performer asks. "Ah, here is one; thank you, madam. You are not a confederate of mine, are you?"

"No."

"Then I wish you to see me tear this glove to pieces, else the audience will say afterwards, either that I changed it, or that you were my assistant."

And so the glove is torn, and the pieces thrown on the stage. Again the performer wants to borrow.

"Will some gentleman lend me a watch? Thank you, this will do."

As he takes it, however, it strikes the hour, and informing his audience that a *repeater*, though useful to a politician, will not answer his purpose, he returns it. He tries two or three, but, strange to say, they are all *repeaters*. Failing in getting another kind, he places the last one offered, with the fragments of the glove, into a pistol which is furnished with a funnel-shaped tube, and aiming at a piece of black cloth, which his assistant holds, he fires, and at the same moment the watch and glove appear suspended on the cloth.

When the performer borrows the glove, he takes it with the fore-finger and thumb of his right hand, makes it into as small a roll as possible, and then with tips of his fingers, places it in his palm. At the same moment he allows a second glove to appear, which he has had concealed under his second, third and little fingers, which until now he has held closed. This glove he passes from his right to his left hand, and if the change is made rapidly, it will never be detected, but the audience will still suppose that they see the same glove that was borrowed.

It is this second glove that is torn up after the borrowed one is concealed. To conceal this without being detected is no little art, and unless explained my readers may be at a loss how to do it. When the performer comes down into the house to borrow the glove, he carries his *wand* in his right hand, apparently for the sake of effect, but really as an excuse for keeping the hand closed, as the second glove is concealed in it. When about to take the glove from the lady, he tucks his *wand* under his arm, and then after the change is made, he takes it in his right hand again, and, as if to get it out of his way, thrusts it into his breast pocket, and the borrowed glove with it.

The watches which strike the hour, do not strike at all, but the striking is done by a repeating apparatus, which is worked by pressing a small button. This apparatus, which is no larger than a watch, is concealed about the person. I have always worn it under the waistband of my trousers, the button turned in. When I wanted it to strike, I distended my belly—don't be shocked—and as long as the pressure on the button was kept up, just so long the striking would continue. Others wear it on the muscular part of the arm, and, by throwing out the muscle, press the button, but I think my method better than any other.

When the performer returns to the stage to get the pistol from his assistant, he hands him the borrowed watch and glove. These, the assistant fastens to the upper part of a piece of cloth, and then folds the cloth so as to conceal them. The pistol which receives the substituted watch and glove, is a very simple affair, being an ordinary weapon to which is fitted a large brass or tin funnel; inside this funnel is a tube which fits into the barrel of the pistol, and comes nearly to the mouth of the funnel. It is between this tube and the sides of the funnel that the articles are packed, and of course they are not affected at all by the discharge of the pistol.

To make the articles appear on the cloth, the assistant merely drops the fold of the cloth at the moment the performer fires.

The repeating apparatus, any ingenious watchmaker can make, or it may be purchased where other magical apparatus is sold.

This trick is somewhat similar to another very popular one known as

The Broken Plate.—In this trick, the performer begins by sending his assistant into the house to borrow two or three watches. These he receives on a china plate, and as he returns to the stage, he unfortunately trips, and, falling, smashes to atoms the plate and watches.

The performer regrets this accident, not so much on account of the damage done to the watches, "For those," he says, "I can easily replace by others equally as good. But as for my plate, it is a loss which I fear, I can never make up, as it is one of a set of china which has been in my family for many centuries. There is a superstition too connected with it, that whenever a piece is broken, some calamity is about to befall the owner. In this in-

stance, you see, the superstition has proved correct, for surely it is a great calamity to have to pay for three such watches as those that my assistant just borrowed."

"However," he continues "I must do the best that I can under the circumstances, and as there is no use of blowing up my asistant, I will try the effect of blowing up these fragments."

He then collects carefully, all the fragments of the watches and plate, and places them in the funnel of a gun.

"Now that I have got the pieces together," he says, "I must find some wadding for my gun. Ah! here's good blowing material. The New York *Herald*, that will do first rate, but I still want more." Here he looks about the stage, and then discovering another paper, holds it up and reads.

"Ah, what have we here? The New York *Tribune*. In that goes too, and now if there ain't an explosion, its because gunpowder won't burn, for when those two papers come together, its worse than that terrible time we have read so much of 'when Greek meets Greek.'"

He turns the gun toward the audience, and they see that it is loaded to the muzzle.

He next calls their attention to a large gilt frame which is hanging from the ceiling by two cords. Inside this frame instead of a picture is stretched a piece of black velvet. He informs the audience that "This is a picture of Brooklyn on a moonlight night, but the moon not having risen and the gas not being lit, I am afraid you hardly have a very distinct view of the city."

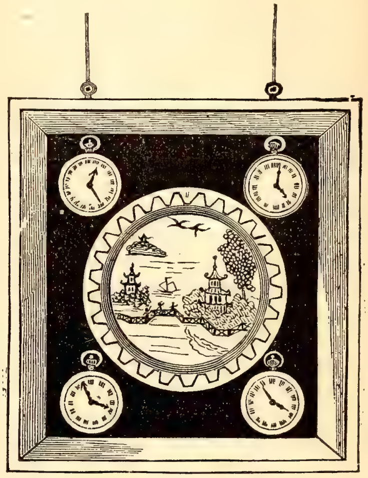
"I now propose to fire the contents of that gun at this picture, and the moment I do so, the city will be illuminated, whilst the watches will be found in the pockets of the owners."

He picks up the gun, which has been lying on a table, aims and fires it at the frame, and on the instant, the plate and watches appear in the velvet as in the illustration. He turns the gun again toward the audience, and shows that it is empty.

The watches he takes from the frame and returns their owners.

A very pretty effect is sometimes introduced by discovering the plate to be imperfect in one place where a piece is out. This piece is picked up on the stage, and when the performer appears to throw it at the frame the imperfection instantly disappears and the plate is perfect.

For this trick you will need two or three brass watch cases, some springs, wheels,



and other watch material, a frame properly prepared, and a peculiar pistol or gun.

The pistol is different from any that I have described, inasmuch as it is furnished with two funnels instead of one; these funnels fit one within the other, and it is in the inner one that the watches, papers, etc., are placed.

When the performer calls the attention of the audience to the picture, he places the pistol on the table, and whilst they are engaged in looking at the frame, the assistant takes out the inner funnel of the pistol, and puts it on the "servant" or shelf at the back of the table; sometimes the performer does this himself before picking up his weapon.

The frame is a shallow box lined with black velvet, and with a velvet curtain falling down in front; this curtain is fastened to a roller, at one end of which is a spring arranged in such a way that the roller will revolve and the curtain fly up, unless held down in some way. A little

catch is at the bottom to keep the curtain down, and a thread is attached to this catch so as to release the curtain at the proper moment. The frame is fastened to the front of the box to give it a finish.

After the assistant has collected the watches, he places his hand over them to guard them, and then as he is returning to the stage, purposely falls, and at the same moment drops the plate together with the brass cases, wheels, etc., which he has held *under the plate* in his hand, whilst the borrowed watches he carefully secures and secretes in one of his pockets. Pretending to be hurt, he limps off the stage, and immediately fastens the plate and watches to the back or rather bottom of the box, pulls down the curtain, fastens the catch, and then carries the frame on to the stage and hangs it to the cords.

When the performer fires the gun the thread is pulled by the assistant, up flies the curtain, and there hang the watches and plate.

The broken piece, is merely a little piece of black silk fastened on to the plate, and this is pulled away at the moment the performer pretends to throw the bit of plate that he has picked up.

Editorial Notes.

Removal.

FOR many years our quarters at 176 Broadway have been too small for our business, and we have been in many respects subjected to great inconvenience thereby. The difficulty and annoyance of moving at a busy season of the year, has hitherto prevented us from making a change, but at last we find ourselves compelled to secure more room and additional facilities. We have therefore leased very large and commodious premises at No. 14 Dey street, about one block from our old stand. Our office and reception rooms will be situated on the second floor (the one immediately over the store), and we propose to have them fitted up in very attractive style.

Please remember the change of address after the first of May.

The Heavens for May.

BY BERLIN H. WRIGHT.

EPHEMERIDES OF PLANETS.—MERCURY rising:

May 12—3h. 57m. morning.
" 15—3h. 52m. "
" 18—3h. 49m. "
" 21—3h. 45m. "

VENUS setting:

May 15—10h. 14m. evening.
" 25—10h. 23m. "
June 10—10h. 24m. "

MARS rising:

May 15—1h. 55m. morning.
" 20—1h. 45m. "
" 25—1h. 35m. "
" 30—1h. 24m. "
June 10—0h. 59m. "

JUPITER rising—

May 15—1h. 44m. morning.
" 25—1h. 9m. "
June 10—0h. 9m. "

SATELLITES OF JUPITER.

	D.	*H.*	*M.*	
SATELLITE I.				
Transit (shad.) begins	3	3	49	morning
Occultation ends	4	4	32	"
Eclipse begins	11	2	54	"
Transit ends	12	3	50	"
" begins	19	3	27	"
" ends (shad.)	19	4	26	"
Occultation ends	20	2	55	"
Transit (shad) begins	26	4	0	"
" ends	28	2	10	"
SATELLITE II.				
Transit begins	8	3	3	"
" (shad) ends	8	3	23	"
" (shad) begins	15	3	3	"
Occultation ends	17	3	46	"
Eclipse begins	31	3	24	"
SATELLITE III.				
Transit ends	2	3	25	"
" begins	9	4	1	"
" (shad.) begins	16	2	47	"
Occultation begins	27	2	13	"

SATURN rising:

May 10—3h. 24m. morning.
" 20—2h. 48m. "
" 30—2h. 11m. "
June 10—1h. 30m. "

URANUS setting—

May 15—1h. 24m. morning.
" 25—0h. 44m. "
June 10—11h. 38m. evening.

REMARKS.—MERCURY will be brightest as a morning star May 15-18, but he is so far south of the sun, and the twilight begins so early, that we think it will be useless to look for him at this elongation.

VENUS is moving eastward past the stars of Gemini, and from May 13 to June 10 passes through the constellation, being a few degrees south of the bright stars Castor and Pollux

May 18—North of Mercury about 9°.
" 19— " Neptune " 7°.
" 24—South of Venus " 1°.
" 28— " Uranus " 4°.

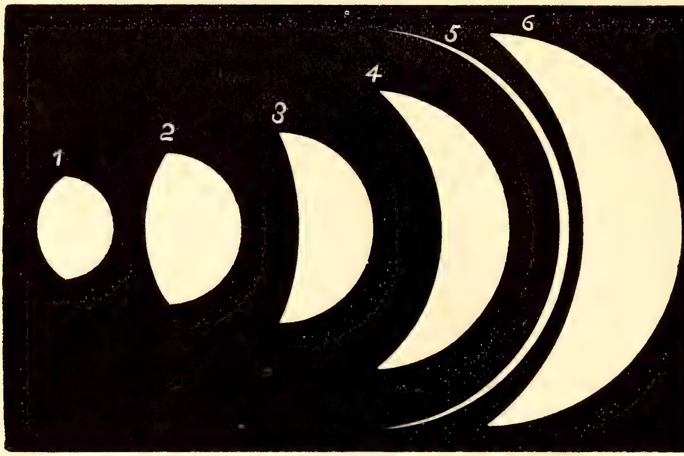


Fig 1.

(1) May 10—Apparent diameter, 14″.
(2) July 1—Apparent diameter, 10.5″.
(3) July 26—Apparent diameter, 14″.
(4) Aug. 19—Apparent diameter, 20″; brightest.
(5) Sept. 20—Apparent diameter, 30″; three days before inferior conjunction, as seen in daylight.
(6) Sept. 10—Apparent diameter, 28″; thirteen days before inferior conjunction.

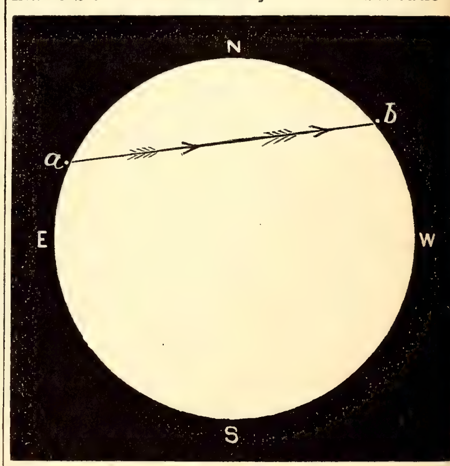
about the 30th. On the 20th she will be directly north of Sirius, and with Betelguese on the S. W., and Procyon on the S. E., will form a large diamond having sides about 26° long. The figures in diagram (Fig. 1) show the phases through which she passes in the four months, from May 10 to Sept 10.

It will be seen that on Sept. 10 her apparent diameter will be four times what it is May 10; in other words, she is apparently *sixteen times* as large. The illuminated portion will be towards the sun in all cases. Any small telescope or good opera glass will reveal these phases, and if the instrument be a good one, a low power should be used, as small telescopes have detected in Venus what the most powerful instruments have failed to reveal. Galileo was the first man who saw these phases, and thus by the aid of his simple, home-made telescope, this great man demonstrated the truth of the Copernican theory.

THE MOON.—The Moon will be in conjunction with the planets as follows:

May 1—South of Uranus about 4°.
" 14—North of Jupiter " 5°.
" 14— " Mars " 6°.
" 17— " Saturn " 8°.

The Moon will occult the first magnitude star Antares June 3, the Moon being nearly at the full at the time. The cut shows the points of immersion and emersion, for the latitude of



(*a*) First contact, 10h. 56m. evening 3d.
(*b*) Last contact, 0h. 2m. morning 4th.

OCCULTATION OF ANTARES BY THE MOON, JUNE 3–4.

Washington. (The data for this occultation are taken from the "American Nautical Ephemeris," and Washington mean time is given.) The star contacts the Moon's eastern limb at 10h. 56m. evening, remains behind the Moon 1h. 6m., and emerges at her western limb at 0h. 3m. morning of the 4th.

LONG PERIOD VARIABLES.

Date.	*Star's Name.*	*Phase.*	*R A.*	*Declination.*	*Period in Days.*	*Change of Magnitude.*
May 1.	*S* Ursae Majoris.	minimum.	12h 38m.	61° 48′ north.	226.6	7.5 to 12
" 6.	*R* Camelopardi.	maximum.	14h 28m.	84° 25′ north.	265	7 to 13
" 9.	*Chi* Cygni.	maximum.	19h 51m.	34° 44′ north.	sev. yrs	4.5 to 5.5
" 11.	*V* Virginis.	maximum.	13h. 21m.	2° 31 south.	252	7 to (?)
" 17.	*S* Piscium.	maximum.	1h. 11m.	8° 14′ north.	13 m.	6 to 13
" 20.	*R* Canis Minoris.	maximum.	7h. 2m.	10° 13′ north.	367	8 to 10
" 24.	*Omicron* Ceti (Mira)	minimum.	2h 12m.	3° 34′ south.	331.336	2 to 12
" 25.	*S* Cephei.	minimum.	21h. 37m.	78° 3′ north.	470	8.9 to 11.12
" 27.	*R* Arietes.	maximum.	2h. 9m.	24° 27′ north.	186	8 to 12
" 27.	*S* Herculis.	maximum.	16h 46m.	15° 10′ north.	305	7.5 to 12.5
" 28.	*U* Capricorni.	maximum.	20h. 41m.	15° 16′ south.	420	11 to 13.5
" 29.	*T* Capricorni.	maximum.	21h. 15m.	15° 43′ south.	274	9 to 14.5

VARIABLE STARS.

S CANCRI—Minima:
May 8—10h. 15m. evening.
" 27—9h. 33m. "
Delta LIBRÆ—Minima:
May 15—3h. 6m. morning.
" 22—2h. 41m. "
" 29—2h. 15m. "
U CORONA—Minima:
May 2—5h. 33m. morning.
" 9—3h. 16m. "
" 16—0h. 59m. "
" 22—10h. 41m. evening.
" 29—8h. 24m. evening.

The above phenomena are all visible, occurring while the star is above the horizon.

Penn Yan, N. Y.

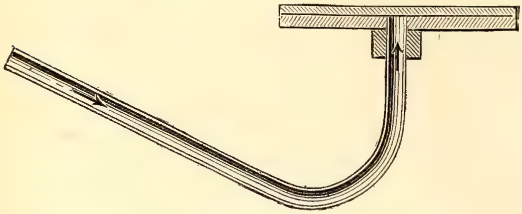
Ebonized Wood Furniture.

There are two kinds of black stains for wood. First, the ordinary black stain for different kinds of wood. Second, the black ebony stain for certain woods which approach nearer to ebony in hardness and weight. The ordinary black wood stain is obtained by boiling together blue Brazil wood, powdered gall apples, and alum, in soft water until it becomes black. This liquid is then filtered, and the objects painted with a new brush before the decoction has cooled, and this repeated until the wood appears of a fine black color; it is then coated with the following liquid:—A mixture of iron filings, vitriol, and vinegar is heated (without boiling), and left a few days to settle. If the wood is black enough, yet for the sake of durability it must be further coated with a solution of alum and nitric acid, mixed with a little verdigris, then a decoction of gall apples and logwood dyes are used to give it a deep black. Soft pearwood is preferable to all others for black staining. For the fine black ebony stain, apple, pear, and hazel wood are the best woods to use; when stained black, they are most complete imitations of the natural ebony. For the stain take—gall apple, 14 oz.; rasped logwood, 3½ oz.; vitriol, 1¾ oz.; verdigris, 1¾ oz. For the second coating a mixture of iron filings (pure) 3½oz., dissolved in strong wine vinegar, ¾ of a litre (1½ pint nearly), is warmed, and when cool the wood already blackened is coated two or three times with it, allowing it to dry between each coat. For articles which are to be thoroughly saturated, a mixture of 1¾ oz. of sal ammoniac, with a sufficient quantity of steel filings, is to be placed in a suitable vessel, strong vinegar poured upon it, and left for fourteen days in a gently heated oven. A strong lye is now put into a suitable pot, to which is added coarsely-bruised gall apples and blue Brazil shavings, and exposed for the same time as the former to the gentle heat of an oven, which will then yield a good liquid. The woods are now laid in the first-named stain, boiled for a few hours, and left in it for three days longer; they are then placed in the second stain and treated as in the first. If the articles are not then thoroughly saturated, they may be once more placed in the first bath, and then in the second. The polish used for wood that is stained black should be "white" (colorless) polish, to which a very little finely-ground Prussian blue should be added.—*R. Pearson.*

—Ice is now being manufactured in Tennessee, Georgia and other Southern States, at one cent per pound.

The Pneumatic Paradox.

This singular experiment was first brought to the attention of the public about fifty years ago, and although known to readers of technical journals, seems to have escaped the notice of the writers of our ordinary works on natural philosophy.



THE PNEUMATIC PARADOX.

The only materials required are two discs of card or wood, and a tube which may be of glass, metal, or even tobacco-pipe stem.

From a stiff card cut two discs or circles about two and a half inches in diameter. One is to be left plain, and through the centre of the other punch a hole the same size as the outside of the tube. Then fasten to the under side of the card, with sealing-wax or paste, a piece of cork with a hole in it the same size as that in the card. This is to make a bearing for the insertion of the tube.

To make the tube, the best material is a piece of glass tubing about a quarter of an inch in diameter. This may be bent in the flame of a common spirit-lamp, and inserted in the cork, as shown in the engraving, when the apparatus will be complete. Where glass is not procurable, any tinsmith can make a tin tube that will answer the same purpose. If carefully bent over the thumb, it may be curved without flattening or wrinkles; but those who do not succeed in this way may first fill it with sand or melted rosin, and it may then be bent without danger.

Having constructed this very simple little apparatus, it will be found that the utmost power of the lungs will fail to blow the upper disc off the lower one. Nay, more: If the position of the instrument, as shown in the figure, be reversed, so that the disc attached to the tube shall be uppermost, and the loose one below it, it will be found that on blowing through the tube the loose disc will not fall away from the other one, but will adhere strongly to it! The loose disc may even be attracted from a short distance, say half an inch, and actually raised up by the stream of air which presses against it from above!

This little apparatus, which any boy or girl can easily make, may give rise to a good deal of amusement. Most persons, if asked if, by the force of their lungs, they can raise a cent laid on the upper card, will answer "Yes" On trying it, they are sure to fail, and at first think that it is the cent that keeps the card down. They will be greatly surprised to find that they cannot lift the bare card, and still more astonished when they see that it is totally impossible to blow the loose card away, even when the instrument is turned upside down, as we have just described.

The principles involved in the action of this little instrument are not very easily explained, and although many plausible solutions have been given, a good deal of uncertainty still hangs over the subject.

BOOK NOTICES.

The Ornamental Penman's, Engraver's, Sign-Writer's and Stone-Cutter's Pocket Book of Alphabets. London and New York: E. & F. N. Spon.

This is a neat little oblong 12mo volume, containing thirty-two plates of alphabets. It will prove specially valuable to those who wish to finish off their drawings handsomely by a neat title, for it is a fact well known to every draughtsman that while a poor drawing, well lettered, may present a tolerably respectable appearance, the very best drawings may be spoilt and rendered repulsive by poor lettering. One great point in favor of this little book is its moderate cost.

Practical Instruction in Animal Magnetism. By J. P. F. Deleuze. Translated by Thos. Hartshorn. Revised edition, with an Appendix of Notes by the Translator, with Letters from Eminent Physicians and others descriptive of Cases in the United States. 12mo, pp. 524, cloth. Price $2. New York: Samuel R. Wells & Co.

This subject is one to which we have given very little attention, and consequently we do not feel able to pronounce an opinion in regard to the value of this work. It is a large volume, neatly got up, and for those who desire to study the subject, we should consider it a most desirable work.

Section Cutting. A Practical Guide to the Preparation and Mounting of Sections for the Microscope; Special Prominence being given to the Subject of Animal Sections. By Sylvester Marsh. Reprinted from the London edition. With Illustrations. 12mo., cloth, gilt title. Price 75 cents. New York: Industrial Publication Company.

The majority of the most important objects studied by the microscopist, demand for their thorough examination that they be reduced to thin sections. The ordinary works on the microscope are somewhat meagre on this special branch of laboratory work, and Dr. Marsh has

done good service by giving simple and yet very complete directions for all the operations connected with section cutting. To the American edition has been added notes equal in amount of matter to quite half the original work. These not only explain such English terms as *Rangoon oil*, etc., but give a very complete and fully illustrated article on the selection and keeping in order of section knives.

Practical Hints.

Liquid Glue.—Dilute officinal phosphoric acid with two parts, by weight, of water, and saturate with carbonate of ammonia; dilute the resulting liquid, which must be still somewhat acid, with another part of distilled water, warm it on a water-bath, and dissolve in it enough good glue to form a thick, syrupy liquid. It must be kept in well-closed bottles.

Coppering Iron or Steel.—The following process is said to give very good results: First make the article entirely bright by file, scratch brush, or any of the usual modes. Apply to the surface a coating of cream of tartar, then sprinkle the surface with a saturated solution of sulphate of copper, and rub with a hard brush. The coating of copper deposited on the iron is said to be very even and durable.

Cleaning Glass Bottles.—It is stated that glass bottles may be quickly and thoroughly cleansed from all traces of adhering fatty or oily matters by the use of a concentrated solution of permanganate of potash to which a few drops of hydrochloric acid are added. The solution is employed by washing and rinsing. The hydrochloric acid sets free a little caustic potash, which in some way appears to be more active in its effect upon the oily or greasy matters than,when presented in the ordinary way. We wish it understood that we do not vouch for the value of this recipe. We reproduce it from the *Druggists' Circular* merely as a hint which may be cheaply tried.

Standard Measures.—The standard yard, now in use in the United States, was taken from the English standard yard; but it was subsequently shown that this standard, as deposited in the office of weights and measures at Washington, was incorrectly taken off—it being 0.00005803 longer than the English imperial standard yard. This difference was no doubt due to incorrectness of the divisions on the original scale, or derived from insufficiently delicate appliances for reading off the measure from the English standard.

It cannot be expected that the divisions on the English scale could be very correct, from want of knowledge in those days to make a correct screw, which is yet a difficult problem, even with our advanced knowledge of mechanic arts. But as it was originally intended to have the English and American standards of length alike, we ought not to acknowledge any difference.

The Smithsonian Institution published tables in 1859, comparing the length of the English and American foot measures, which makes the American yard 2-1000th parts of an inch longer than the Imperial standard yard, or a difference of four inches per mile. The United States Coast Survey are now using a corrected American standard yard, the same length as the Imperial standard yard.—*Journal Franklin Institute.*

Bronzing Wood, Leather, Paper, Etc.—The *Moniteur Industriel*, of Paris, describes a process for bronzing wood, leather, paper, etc., as follows: The inventor dissolves gum lac in four parts by volume of pure alcohol, and then adds bronze or any other metal powder in the proportion of one part to three parts of the solution. The surface to be covered must be very smooth. In the case of wood, one or several coats of Mendon or Spanish white are given, and the object is polished with an iron of proper shape. The mixture is painted on, and when a sufficient number of coats have been given, the object is well rubbed. A special advantage of this process is that the coating obtained is not dull, but can be burnished. A transparent varnish is applied to preserve the metallic appearance thus obtained.

Washing Glass.—The following hints apply to glass slides used in microscopy, as well as to chemical vessels. A correspondent of the *Chemical News* says: Such a subject may seem too simple, but yet the more I see students at their work, the more I am impressed with the fact that but few know how to wash a beaker-glass clean. Some time since I took beakers from various students in my laboratory (which they had washed and put away), and held them under a powerful stream of water until they were thoroughly wet. On taking them from under the spout, in almost every case the water ran off the glass in spots, showing that the glass was greasy. The best thing to wash beakers, etc., with, according to my experience, is sand-soap. Naturally, the sand must not be sharp. The soaps containing infusorial earth are most excellent for this purpose. Borax soap is also very efficacious. A piece of board about 20 cm. long, 15 cm. wide, and 4 cm. thick, should be screwed on to the right (inside) of the sink. In this block a rectangular hole, about 2 cm. deep, and 1 cm. smaller than the section of the soap when stood on its long end, is to be cut. The bottom of the cake of soap is then whittled away so that it fits tightly in the hole. It is now moistened and pushed into the aperture, where it remains tightly fixed. By wetting the right hand thoroughly, and rubbing on this soap ridge, a good lather is made. With the soapy hand the glass is rubbed and washed until. on taking it from under the stream, no oily spots appear, the glass appearing wet all over. The beaker is then dried with a good towel ("glass towel"), and finally polished with a piece of chamois or kid leather. The final polish with kid is necessary, since the best towel leaves fibres on the glass. In cleaning test tubes, it is only necessary to rub the probang on the soap.

EXCHANGES.

Yearly subscribers to the Young Scientist have the privilege of inserting three exchanges (or one exchange three times) during the year. This privilege is strictly confined to *exchanges; buying and selling* must be carried on in the advertising columns, where the charge is 30 cents per line. Each exchange is limited to thirty words, making about four lines, and in order to receive attention must be written on a slip of paper by itself. We file all letters received, and have no time for copying out exchanges and queries.

As we desire to make the journal of the utmost value to *all*, and not merely to serve the interests of individuals, we shall strictly adhere to these rules, which are certainly liberal, giving as they do advertising to the value of $3.60 free to each subscriber.

Wanted, a collection of Southern woods, for a collection of New Hampshire woods; will exchange for rough pieces. W. P. Adams, Pittsfield, N. H.

For exchange, a guitar, patent head, nearly new, cost with strings $14—splendid instrument, in good order; state what you have to exchange. W. Z. Allen, Monrovia, Ind.

A No. 1 self-inking Official press, costing $10, and $13 worth of type and fixtures, to exchange for a combined bracket saw and lathe, or offers. C. A. Bacon, Elba, Lapeer County, Mich.

To exchange, Bourne's "Treatise on the Steam Engine," cost $5, for chemical apparatus and chemicals of the same value. E. T. Birdsall, 39 East 22d street, New York.

Wanted, 350 or 400 different kinds of foreign stamps; state what is wanted in exchange. John S. Briggs, Newark, N. Y.

Wanted, January and March (1878) Nos. of Young Scientist in exchange for the "Mineralogist Companion." Walter Brockstedt. 2118 Carondelet Avenue, St. Louis, Mo.

Printing press, cost $35, and several fonts of type, in exchange for anything pertaining to science, literature or art. E. S. Dayton, Basking Ridge, N. J.

To exchange, one telegraphic key and sounder, in good shape; also a new scroll saw; state offers, John Duff, Jr., Pontiac, Ill.

Two Bunsen batteries to exchange for engraver's tools, or Vols. 1 and 2 of Scott's "Coin Journal," or old U. S. coins. Clark Horn, Jr., Box 582, Scranton, Pa.

An oscillating steam engine, 1-inch bore, 2-inch stroke, for a Queen's Household microscope, or offers. L. Kent, Santa Anna, Los Angeles Co., Cal.

Wanted, in exchange for valuable books (of which lists will be sent on application), Packard's "Guide to the Study of Insects," edition of 1876. C. H. L., 57 North 1st street, Edgefield, Tenn.

To exchange, cocoons of Attacus Luna, Cecropia and Polyphemus, for specimens of entomology or geology. Geo. A. Lippincott, Box 50, Watsontown, Northumberland Co., Pa.

A new stationary steam engine of ½-horse power, worth $30, in exchange for a good watch, or almost anything; mention offers. H. Mackenzie, Jr., Petroila, Ontario, Canada.

To exchange, complete set drawing instruments, cost $3; state offers. J. Mueller, 2453 Kosciusko street, St. Louis, Mo.

In exchange for books, a Novelty printing press in excellent condition, prints a form 6½x10½ ins.; cost $32, ink roller cost 75c., and $1.50 worth blue ink. J. A. Osborn, Scientist, Mahmal, Cambridgeport, Mass.

To exchange, a Novelty printing press, type and accessories, for a microscope with accessories, or minerals, or offers. T. W. Patterson, Warsaw, N. Y.

Will exchange one or more of my new extension step fruit ladders, the "Climax," price $2.50, for merchandise. H. E. Phelps, Marshall, Mich.

Wanted, an achromatic photo camera, a good shotgun, or scientific books or apparatus, in exchange for a fine scroll saw in good condition. A. B. Porter, 501 N. Tenn St., Indianapolis, Ind.

"The History of Our Country," by Benson J. Lossing, cost $15; also other books to exchange for scientific and practical books and apparatus. H. M. Rauschkolb, 246 Delord St., New Orleans, La.

Telegraphic key and sounder, finely wrought on proper base, cost $8; will exchange for good revolver. S. G. Reese, Box 133, Elizabethtown, Lanc. Co., Pa.

To exchange, one set of Lily carving tools of three pieces; state what is offered in exchange. B. M. Rockwood, Franklin, Mass.

Wanted, a first-class work on entomology, with colored plates, for Stanley's Travels, calf bound, nearly new; also other books and minerals to exchange. H. Salisbury. Box 399, Whitewater, Wis.

Wanted, a coachmaker's vice, opening 8 or 9 in., in good order, or a lot of thumb screws, in exchange for an E-flat cornet worth $15, or violin worth $12. B. H. Smith, New York Mills, Oneida County, N. Y.

Wanted, a Seltz's boys' theatre; state what is wanted in exchange, and give full particulars of the style of theatre. H. C. Spaulding, 7 Princeton street, Boston, Mass.

Kane's Arctic Explorations, for a small printing press with type and ink. H. B. Taylor, Tehuacana, Limestone Co., Texas.

A game of parlor billiards, cost $4, will be given in exchange for something of equal value. J. H. White, Canajoharie, N. Y.

Back numbers of "Youth's Companion," for the years 1877 and 1878, in good condition, to exchange for chemicals, chemical apparatus, or offers. F. Willis, 3 Myrtle street, Boston, Mass.

THE

YOUNG SCIENTIST.

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The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL FOR AMATEURS.

Vol. II. NEW YORK, JUNE, 1879. No. 6.

The Hunted Fisherman.—II.

BY A. W. ROBERTS.

THE next night I again visited the pond, accompanied by my "big brother," our bulldog, and a written permit from the owner of the pond, granting me permission to fish night or day.

I had also extemporized a bathing suit, which consisted of an undershirt and a pair of heavy flannel drawers, to protect me from the leeches and boat-flies. After reaching the pond, we got right to work, and on the first haul, one hundred and fifty sticklebacks were taken, and thousands of boat-flies, which, almost before we could place them in the pail, flew back to the pond. The second haul consisted of two hundred more fish and many masses of nests.

We now prepared to return home, having all the fish that I could take care of. I felt thankful for not having met the policeman, who, in all probabllity, was taking a nap, somewhere on his beat.

The day previous I had taken possession of all my mother's wash tubs, and placed in them a flooring of sand some three inches deep, and several bunches of plants. All the nests were placed in one tub, in the hope that the eggs might hatch out, but at the expiration of three days they had turned "blind," and were soon covered with fungus. This was caused by a want of circulation of the water over the eggs.

Noticing that the male sticklebacks were beginning to show bright colors, I concluded to take my first lesson in fish culture.

Up in the hayloft was a box of window glass; taking a number of panes of glass, I formed in each tub a series of compartments, in the following manner: From the centre of each tub the panes of glass radiated till they came in close contact with the sides of the tub, thus forming a series of acute angles; the bottom edges of the glass were crowded down through the three inches of sand till they rested firmly on the bottom of the tub, and well into the apexes of the angles a bunch of mermaid weed was planted; this also helped to sustain the glass compartments,

as well as to keep up a thorough oxygenation of the water.

In each compartment I placed a pair of sticklebacks, giving them a meal of angle worms before leaving them for the night. Next morning, when I examined the tub, to my great surprise, many nests had been built during the night; in some of them the bright yellow eggs showed plainly through the openings of the nest. Every nest was being vigorously ventilated by the male fish, who were hard at work fanning a current of water on them with their pectoral fins. In other compartments the male fish were tearing off small pieces of confervæ that grew on the mermaid weed, which they carried in their mouths to the nest, packing it down with their noses. After several mouthfuls had been disposed of in this way, they fastened the pieces together by pressing them down more compactly with the under side of the body, at the same time exuding a marine glue, so to speak, that cemented all together securely. In the centre and on the top of each nest were four orifices, and into these the male, after a considerable display of anger, and much driving, at last drove the female, her head projecting far enough out to allow her to breathe. In a few minutes the male drove her out of the nest head first, he now passing through the nest, and over the eggs, just to see, you know, if Mrs. Stickleback had laid her eggs in the proper place, and to make things all right. In an instant he was out, flaming all over with blue, green and orange, his eyes looking like small torquoise. When the eggs became too much exposed through the openings of the nest, he contracted them by cementing on more confervæ. Over the nest he remained day and night, changing from one opening to another, constantly fanning a current of water through them. Whenever poor Mrs. Stickleback showed herself, her mate drove at her fiercely, biting her till she was glad to hide in the mermaid weed. The trouble was that she would have eaten all the eggs if she had had a chance, and he knew it. For this reason I took all the females out as soon as they had deposited their eggs. As each nest was completed, and the eggs deposited, I withdrew the glass partitions, but terrible battles taking place between the males, I had to place them back. Even then they would try to fight each other through the glass. When all the eggs were hatched out, and the bottom of each compartment seemed alive with young sticklebacks, I removed all the male fish and glass partitions, and in a few weeks was the happy possessor of a large "school" of inquisitive, restless, baby sticklebacks.

For collecting, the best kind of a net is what is known as a "scoop net." The handle should be from six to eight feet long, and an inch and a half in diameter. The ring, or scoop, is made of No. 00 wire, thoroughly welded together at the shank. The inner diameter should measure twelve inches. The end of the handle, where the jointed shank is to be driven in, is protected with a ferrule to prevent it from splitting.

The best material for making what is known as the bag of the net is "bobbinet netting," sometimes called by dealers "army netting," shown in Fig. 1. The bag should not be less than 14 inches in depth. When using this net, always have a needle and thread with you, in case of the seams giving way, or holes being torn in it.

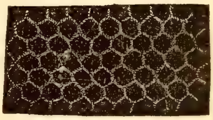


Fig. 1.

Fig. 2 consists of No. 00 wire, bent as shown at A A A A. The top piece, D D, is a piece of wood bound to the ends of the bent wire, A A A A, with strong twine. This piece of wood helps to float the frame of the net in an upright position when in the water. At the mouth of the bag of bobbinet a stout band of muslin, C C, is sewed to the netting, otherwise if the netting was sewed to the iron frame it would cut and tear away in a short time. To the outer edge of the muslin band, tape ties are sewed, two and a half inches apart. With these tape ties the bag or net is

securely fastened to the iron and wood frame.

At B B B are fastened ropes five feet in length. These ropes are for the purpose of holding the net in an upright position when it is drawn through the water, or to make the strain equal on all parts of the net. The ends of these ropes are brought together to a point to which the "warp" line is tied.

If the pond is large where you are going to collect, the best way to use this net is to tie the end of the warp line to a stone or tree, and then cast the net as far out as the line will allow. When the net sinks, and the piece of wood floats, it is in an upright position—haul in. Another way is to tie a stone to the end of the warp line, and cast the stone over the pond to the opposite shore; then setting the net in position in the water, proceed to the opposite shore and pull the net across the pond.

Small streams can be worked very effectually with this style of net, in the following way: Set the net across the stream, in the deepest part, being careful that the bottom of the iron frame rests closely on the bed of the stream, so that no fish can pass under. Now, drive two stakes into the banks of the stream; brace the net to an upright position by tying the side ropes of the net to the stakes. In case the frame of the net is too short to reach across the stream, build up "wings" of rocks, sods and moss, or of brush. These wings will lead the water of the stream and the fish into the net. When the net is securely set, take a lot of brush, to which tie a section of the warp line; now walking down stream, towards the net, everything is swept into it.

I would, however, caution my readers that this method of capturing fish is only to be adopted where specimens are to be captured alive, either for stocking other waters, or aquaria, or for purposes of scientific investigation. I would not have described such an unsportsmanlike way of capturing fish, had it not been that it is already well known to those who are likely to make a bad use of it, and so we may as well give our young scientific friends the benefit of it. Bear in mind that those who adopt this system, except for the purposes mentioned above, are, in most States, and particularly in New York, New Jersey, and the New England States, liable to severe legal penalties.

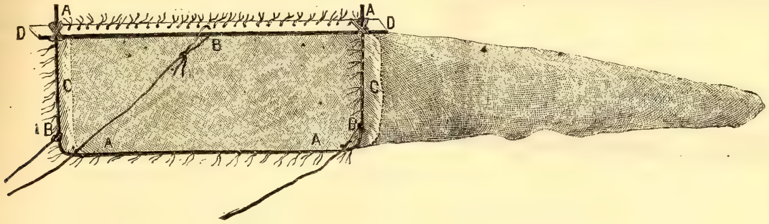


Fig. 2.

This method, however, has the advantage that it enables you to capture everything, without injuring them in the slightest degree. Therefore, after having selected the specimens you desire, always make it a point to return the others to the pond or stream. If even the smallest sized trout is caught in the net, be generous to this lovely fish, and gently put him back into his native element. Never mar your day's enjoyment by taking one home for your aquarium, where he will drag out a wretched existence for a few hours, and die from the high temperature of the water; or jump out of the tank only to be eaten up by the cat. Even if you capture a good sized one, do not take it home to fry, but think what a mean, sneaking way you have captured him. Take all the other kinds of fish you have use for, as they are the natural enemies to trout, their eggs and fry. Then, when spring and summer days come on, and you and your friends wish a quiet day's trout fishing, you can enjoy the finest sport in the world in your own neighborhood.

Scroll Sawing—II.

BY F. T. HODGSON.

FIG. 7 shows a spring steel saw frame, which is a great favorite with some amateurs; it will hold saws from two to five inches in length, and will face them in any direction, which is a great advantage, and makes this saw one of the best of its kind. Frames of this sort can be obtained that will take in a sweep of from eight to fourteen inches, for

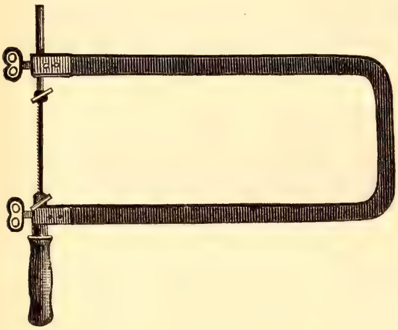


Fig. 7.

about one dollar, for the smaller size, and one dollar and fifty cents for the larger. This style of frame is, perhaps, the best in the market, as it is strong, neat, light, and efficient.

Fig. 8 represents a Swiss saw-frame, but, as the largest of them will only take in about six inches of a sweep, they are not adapted for general work, although

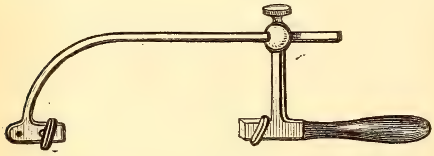


Fig. 8.

where it can be afforded, they will be found very efficient in cutting out small designs, as they are easily adjusted, and the saw can be strained to almost any tension.

Before closing this description of saw-frames for hand work, it will not be out of place to make mention of a very ingenious device that has lately appeared in the market. Fig. 9, will convey some idea as to the shape of this new frame, though

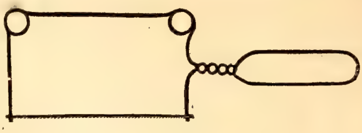


Fig. 9.

this is not the only one it assumes. It is made of spring steel wire about one quarter of an inch in diameter, and is in one continuous piece, the upper corners being turned double, and the narrow part of the handle twisted to hold it together at that point. The ends of the piece are sawed, so as to allow the saw to slip in. The saws used in this frame require to be turned on the ends to keep them from pulling through the slots in the ends of the wire. It has a sweep of about four inches, and can be purchased, with saw complete, for about twenty cents. The tension is obtained by springing the upper arm of the frame until the saw can be put in place, and when the whole is released the frame will spring the saw taut.

The next thing to be considered is some device by which the work can be held while operated on. Of course, the best device for this purpose, is a small carpenter's bench such as was shown and described in the YOUNG SCIENTIST last October, page 126, but as most young people would prefer using an ordinary dining table as a base of operations, it will be necessary to describe how this can be done with advantage. Procure a piece of hardwood board—maple or walnut—about one inch in thickness, twenty inches long, and fourteen inches wide. Bore two holes through the piece, as shown in Fig. 10, one, about four inches from the end, and the other about three inches from the reverse end. Cut V shaped notches up to these holes in about the proportion shown. The third notch is designed for very fine work and has no hole at the extreme end; it will be noticed that the angle of the slot is very acute. On the end of the piece where only one notch is cut, will be seen a short stubby screw, the head of which, by the aid of a screwdriver can be screwed

down until it is below the surface of the board; this screw can be used for holding thin stuff while it is being planed, polished, or sandpapered, as it can be raised to suit any thickness. Workmen call this temporary work bench "a horse," which is a

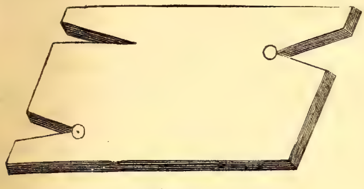


Fig. 10.

very appropriate name. It is fastened to the table by a screw-clamp, vice, or hand-screw; the last named being the better of the three because of its being made of wood, and, therefore, the least liable to injure the table or the "horse." There are many other devices for holding the work in place while being operated on besides the ones mentioned, but they are mostly of a complicated character, and too costly to be within the reach of the young amateur whose means are limited, therefore, no further reference will be made to them.

Besides the saw frame, horse, and hand-screw, the following tools will be indispensible, namely: a few brad awls of different sizes, or better still where it can be afforded, a hand-drill with half a dozen assorted drill points. The former will cost about five cents each, and the latter, drill-points and all complete, can be obtained for one dollar. Fig. 11, shows the hand-drill with point attached, also wrench for taking out, and screwing in drill-points. A few rat tail files will be found

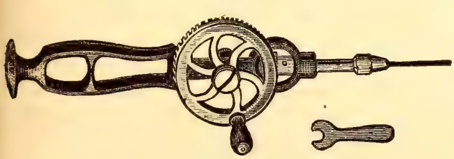


Fig. 11.

very useful in smoothing up the edges of quick curves. A flat file and a couple of three sided files will also be found of great service in finishing up the work after it has left the saw. The files of course, will require to be of different sizes. A tenon saw which will cost about seventy-five cents will often be wanted to cut the stuff near to the size required, and also to cut mitres and straight work where it is outside the pattern. A light claw hammer, a glue pot, and an assortment of small brads will also be found very useful. A piece of cork two inches wide, one inch thick, and three inches long, makes the best rubber known; wrap the sandpaper round it, then smooth up your work and it will be found that the cork will not permit the sandpaper to cut off the sharp angles of the work. Where the cork can not be obtained, a good substitute can be made by taking a piece of flat India rubber and gluing it on to a piece of pine board. When using, keep the rubber side next to the work. It will also be well to have a good supply of saws of all sorts on hand, for the beginner *will* break a number of them before accomplishing much work; but this should not be cause for discouragement, for we venture to say, that no one has reached to any degree of perfection in the art of scroll-sawing, without breaking a large number of saws; with care and practice however, saws can be made to last a long time, and the longer they last, the smoother and cleaner they cut.

Lessons in Magic.—VIII.

The Filtration.

THIS trick is so old, that it will appear as new to most of the present generation, very few of whom have ever seen it. It is a most excellent illusion, and may be exhibited with equal effect in the drawing-room or on the stage.

Two large glass jars, one filled with water and the other with ink, are brought on the stage and placed at a distance from each other. To convince the audience that there is really ink in one, the performer ladles out some and pours it on a piece of white paper which is immediately discolored.

All doubts as to the contents of the jars being satisfied, they are covered with handkerchiefs, and on removing these, it

is found that the jar which contained the ink now holds the water, whilst that which held the water is filled with ink.

For this trick all that is needed is a small packet of good ink-powder and a black silk lining which fits exactly inside one of the vases, and to which is attached a thread. The silk lining is placed inside one of the vases which is then filled with water, and the thread attached to the lining is brought over the side of the vase, so as to be readily accessible to the hand; in this shape it appears as if the vase was really filled with ink, and to complete the illusion a small wooden spoon, the handle of which is hollow and filled with ink. is apparently dipped into the vase and its contents being immediately afterward poured on to a sheet of paper—unsized paper is best, as it absorbs the ink quicker and becomes black much sooner than a sized article—the audience are convinced that it is really a vase of ink that they see. The other vase is filled with pure water. To effect the change the two vases are covered with cloths of any kind, and in removing that which is over the supposed ink, the lining is lifted out by means of the thread, and there appears a jar of clear water, whilst the other jar which held the water is now filled with ink, and a very good article at that, for in covering it, you managed to drop the contents of the packet of ink-powder into the water.

The foregoing trick originated in this way; many years ago there appeared in Paris a conjurer named Phillippe who astonished the whole city by his wonderful tricks. He did many clever things, and amongst others produced a number of large glass bowls filled with water and gold-fish from a lady's shawl. This trick being entirely new, attracted large audiences, so his competitors set their wits to work to discover how the thing was done. This they did not succeed in at the time, but one of them hit on the trick I have just explained, and by it managed for a while to share with Phillippe the patronage he had so long monopolized.

More modern conjurers have combined the two tricks, altering them however both in the manner of performing and the effect, but before proceeding I will explain Phillippe's trick of

The Fish Vases as now Performed.—The "vases" are small round glass bowls of about six inches in diameter, and furnished with rubber caps or covers, which fit tightly on and are retained in their places by the "lip" of the bowl. When about to exhibit the trick, the "vases" are filled with water and gold-fish, the rubber caps put on, and one each of the bowls is placed either in the breast pockets of the performer's coat or waist-coat, or else in large oil-silk bags or pockets, which he wears under his coat.

Instead of a shawl, several large silk handkerchiefs are used. The performer takes one, rolls it into a wad, throws it in the air and tramples it under foot to show that it is empty; then taking it by two of the corners with the tips of his fingers, he brings it over his left arm, letting it fall in such way as to entirely veil his breast and the action of his right hand; whilst in this position that hand searches for and grasps one of the bowls which it brings immediately under the centre of the handkerchief; the left hand is now brought into play to withdraw the handkerchief, and in doing this, it at the same time pulls off the rubber cover which is kept concealed in the handkerchief. The bowl of fish and water is advanced to the audience by the right hand, whilst the left throws the handkerchief and cover on the stage.

These motions are repeated with a variation of the hands, as many times as are necessary to bring out all the bowls of water, a fresh handkerchief being used for each bowl. At the conclusion of the performance the trick of

The Fish Vases and The Filtration Combined may be very readily introduced, as follows: A large glass jar, shaped like a goblet, the base of which is made either of wood, metal or silvered glass, is brought on to the stage, filled to the brim with ink, and given to an assistant to hold.

The performer then picks up one of the bowls of water which he has just brought out of a handkerchief, and re-covering it with another handkerchief, he suddenly throws it into the air, when to the aston-

ishment of all, the handkerchief proves to be empty; the attention of the audience is now directed to the jar of ink, which the assistant has been holding, and although uncovered and not out of sight, the ink has gone, and in its place is pure water.

For this trick the performer requires a bowl, and also a jar of peculiar coustruction. The bowl is made with a piece of glass fitting entirely across its mouth, but at a little distance—say about the eighth of an inch—below the top edge; a hole is then drilled in the bottom, and through this hole the bowl is filled with water and then corked; a little water is poured on to the top of the plate which goes across the mouth, and as this is accidentally (?) spilled in lifting up the bowl, the spectators are impressed with the idea that they see an ordinary bowl filled with water. The handkerchief which is used has a ring of wire about the size of the bowl, sewed to one side of it.

When the performer picks up the handkerchief, he veils his breast with it, in the same manner as when taking out the bowls, but this time puts *into* his pocket the glass jar which is in his right hand; then passing that hand under the handkerchief, he causes its folds to fall in such a way about the wire ring which is fastened inside, as to give an impression from the shape that the bowl is still inside. When the time comes for the disappearance, the handkerchief is tossed into the air, caught as it is falling, and shaken so as to show that it is empty.

The jar which holds the ink is double, or may be more easily arranged by fitting two jars one inside of the other; between these sides is a black silk lining which is attached to a coiled spring in the base of the jar. There is a button on the outside of the jar-base which controls this spring. When the performer commands the jar to "change!" the assistant pushes the button, the spring is released, and the lining flies into the base, revealing the pure water in the jar.

—A model of New York harbor, with real water and miniature shipping, is on exhibition in Boston.

Engraving on Wood—IV.

BY SARAH E. FULLER.

IN our last paper we described the way in which to cut the picture of flowers and leaves. We will now give you some instruction that was anticipated somewhat by our last lesson. If you have tried to cut the picture, you will understand the lesson we now give you.

The first thing to learn, is how to hold the tools. Hold the handle of the tool, with the second, third and fourth fingers of, and the palm of the right hand, grasping firmly, and with precision, but yet lightly, and use the forefinger to guide the tool. In cutting small pictures, let the thumb be pressed against the side of the block, as shown in Fig. 13.

At no time, should the tool be held or pinched between the forefinger and thumb; the forefinger always guides the tool, and the thumb acts as a rest, the other fingers and palm holding and moving the tool as required. By attending to these points in the beginning, you will acquire the habit of working with freedom, and yet with a precision, which will be impossible to gain, if you do not hold the tools properly.

When the blocks are large, the thumb rests on the face of the block, as shown in Fig. 14.

The tool held as we have told you, plays forwards and backwards against the thumb, which rests steadily, while the tool is cutting, but moves whenever, and as fast as is required. It generally takes considerable time to get the habit of holding the tools correctly. It is sometimes useful practice to hold a tool, and go through the motions of cutting, without a block. One needs suppleness of the fingers, and delicacy of touch, which may be promoted by this exercise.

For a regular course of lessons in engraving, the first lessons are in cutting tints. By tints we mean those portions of engravings that are made with a series of regular lines without having cross lines.

For a first trial, choose a small piece of wood; an inch or so square will answer. Prepare the wood as we instructed in a

former number; pumice it carefully, so as to leave no scratches, and whiten it lightly. When quite dry, rule lightly with a fine pencil, some "guide" lines, from the top to the bottom about quarter of an inch apart.

Place the block on your sand bag cushion described in March number, and all your apparatus adjusted as there directed. Hold the block with your left hand firmly to prevent it slipping, but so that you can readily move and turn the block as required while engraving. The left hand performs a very essential service in making engravings.

Select a tool of medium grade for the first lesson, holding the tool and adjusting the block as described; commence near the upper edge, and just on the right side; guide the tool with the forefinger, and cut slowly, and not too deeply, a line straight as possible across the block. It would be well to cut this first line, just below the pencil "guide line," at the top of your block. Keep the same pressure of tool into the wood throughout the entire length of line. Having determined what width of line, or "face" you will leave, when you commence the second line, place the tool at the required distance below your first cut, and cutting into the wood the same depth as before, guide the tool slowly across the block, endeavoring to leave the line as wide throughout its entire length as at its beginning.

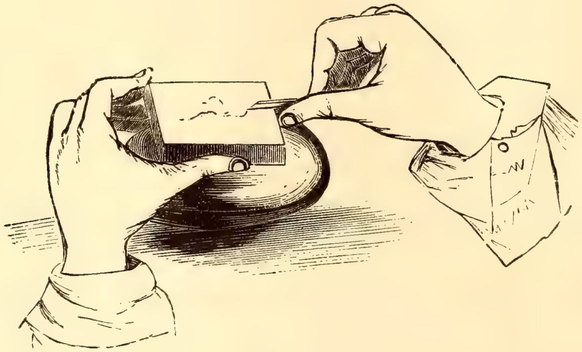


Fig. 13.

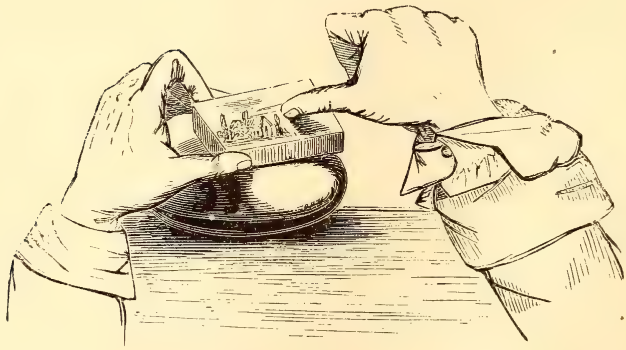


Fig. 14.

The line that is between your two cuts is the first line of your tint, for the lines that are left are the lines that receive the ink in printing, and the straight cuts appear white. The quality of plain tint de-

pends upon the evenness of the lines which make it, both the black lines, and the white cuts. The color or tone depends upon the width of these lines and cuts.

If possible to cut the second line without either swerving upwards, making the line thinner, or downwards making it thicker than at its commencement, a great success has been achieved by our student. commence every line carefully, and proceed slowly, observing closely with the eye the width of the lines left, and with the fingers the depth of the cuts. You

Fig. 15.

will now understand why you were instructed to hold the tools so carefully, for to know at what depth you are making the cuts, requires great delicacy of touch, which you will perceive more and more as you proceed. Do not think about the time required to cut a line ; let each line for the time being be the most important matter in the world, and proceed as carefully as if you expected to receive hundreds of dollars for the beauty and precision of your first tint block. The "guide lines" in pencil will enable you to observe whether you are cutting your lines straight, but if, unfortunately, the lines get to swerving up or down, do not continue in the wrong direction. Stop, and take the tool out of the cut, and put it into the wood a little further along, and observing its distance from the nearest guide line, commence again. It is better to have stops in the tint than crooked lines. It will take quite considerable time to get accustomed to the use of tools, so that it will be possible to cut an even tint; but patience and perseverance will be re warded with success.

Collecting and Pressing Seaweeds—I.

THE study and collecting of seaweeds (algæ) is a delightful recreation, particularly during the summer months, when so many are spending their vacation on the seashore, and are at times lost for something to do.

The seaweeds of our coast are in their greatest beauty and variety during our hot summer months. A tide table, or a friendly and communicative fisherman, is indispensable for reference, as by consulting either of these you can always be sure of striking the particular part of the coast at just the beginning of ebb tide, which will give you a chance to collect all the way down to extreme low tide, and then as the water returns laden with a rich harvest of "drift," time and opportunity is at hand for a rich haul. In this way a locality can be thoroughly worked. To save time, and take full advantage of the ebb and flood of the tide, do not stop to wash the specimens carefully, but pack them in your basket compactly together, always remembering to keep the temperature outside and inside the basket as low as possible, or the mass of seaweeds will become heated, and fermentation will take place, which will utterly destroy every specimen. The surest means that I know of for protecting the specimens from the action of heat is to have a large thick towel or blanket loosely laid inside the basket, extra pieces of blanketing or towels to cover over the top surface of the seaweeds, and to go around the outside and bottom of the basket. These outside wrappings are to be fastened on the basket with string previous to starting home.

When on your ground collecting, always keep the basket sunk in some quiet and shady tide pool; as you collect the specimens take them to the basket and place them in it in layers. Rocky and sandy shores are always the best and cleanest locations to collect from; old docks built up on spiles are always great hiding places for the more delicate kinds of algæ that delight in shady cool locations, and the action of gliding water. Always try to be on your collecting ground at the

spring tides, consult your almanac for the times of new and full moon, and cultivate your friendly fisherman with a cigar or paper of tobacco, and politeness, which costs you nothing, but is always appreciated by these salty and very honest people. As a rule they are shy and reticent towards city folks, but when they know you they are always ready and pleased to post you as to particular locations on the coast where desirable specimens may be obtained in abundance. Or where the tide has cut into the land, thus forming "dykes" and "overlopes." During the spring tides these "dykes" are always desirable places for the seaweeds of quiet habit. Always after the heavy gales and spring tides there will be found on the high water line of our coasts, piled up in masses, immense quantities of seaweeds in the form of drift. This should be gone over carefully and will be found to be rich in deep sea specimens.

There are various methods of preserving seaweeds, and the best of them all consists in mounting them on paper. After having reached home with your specimens, it is necessary to begin preparing them for the press immediately as seaweeds soon spoil after their removal from their native element. The red weeds must be taken in hand first, as they begin to decay quicker than the other varities on account of containing a large percentage of gelatinous material (I have known them to *melt* away in two hours time after being out of water). Wash *all* your specimens in *clear salt* water that has previously stood some time to settle. By salt water I mean water taken from the ocean or river where the plants were collected. Fresh water will do if the salt cannot be obtained, but it has a decided tendency to change the colors of the seaweed, and also to rot them; still if the specimens are handled very quickly it will answer. For floating the specimens I have found a large meat dish (white) such as is used for serving large joints, to be the best. Fill such a dish with water, not up to the rim but as far as the shoulder or bend of the rim. Now immerse the paper under the water and place the specimen on top of it, allowing it to assume its natural habit of growth as near as is convenient for the size of the mounting paper. Now carefully and slowly lift out the plant on the paper, and lay it on a smooth board placed in a standing position so that the water will drain off. If parts of the plant become matted together, separate with a camel hair brush or sharp pointed stick. The spreading out of the finer parts of the plant can be accomplished very nicely by taking up a drop of water on the end of your finger and allowing it to fall on the part you desire to spread out.

Seaweeds can be dried with great success, and packed away for winter's entertainment, in the following manner. After having obtained your seaweeds, procure an old sheet, or piece of canvas which is to be staked to the ground with wooden pins cut from small branches of trees, (Fig. 1). These are hooked into holes that

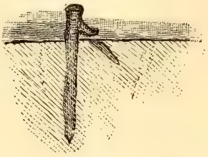


Fig. 1.

are perforated all along the edges of the sheet, and the long legs of the pins are driven into the earth. In this way the sheet is kept in position and spread out, all danger of the wind getting under it and scattering your specimens is avoided. On the sheet is spread a thin layer of *dry* and *clean sea sand*. As each specimen of seaweed is taken out of the water it is allowed to drip for a few moments, after which it is laid on the sand. The purpose of the sand is to rapidly carry off all moisture and disperse it by evaporation, and also to prevent the seaweed from sticking to the sheet. When the specimens are just so dry that they are pliable, *but not crisp*, place them in covered boxes to be kept till required for mounting. This drying must always be accomplished in the shade, as sunlight fades the colors, and the heat produces fermentation causing the gelatinous specimens to change into a pulpy mass.

In case clean fine sand is not attainable,

the specimens can be suspended on lines of strong thread stretched across some cool, dry, room that is free from dust.

For preserving the large coarse olive colored weeds with a view to studying their organs under the microscope, they should be immersed in pure glycerine, in which they will retain their natural color and form for several years.

One of the best portable presses that I know of consists of two bars of well seasoned oak or chestnut, with thumb screws at each end, and a few planed deal boards less than half an inch in thickness; these are varnished with black asphalt varnish. The board should be about eighteen inches long by about a foot broad. The screws should be well finished and at least six inches long, so that several pairs of boards can be pressed at once. These thin boards and a good supply of *clean* cotton or linen rags are all the apparatus necessary for field work.

The boards will be found very useful to lay the sheet of mounting paper on, holding it and the end of the seaweed firmly on the board with the left hand, under water in some quiet tide pool, using the right hand to adjust the specimen. After the seaweed is in position, the board can be stood up till the water has run off.

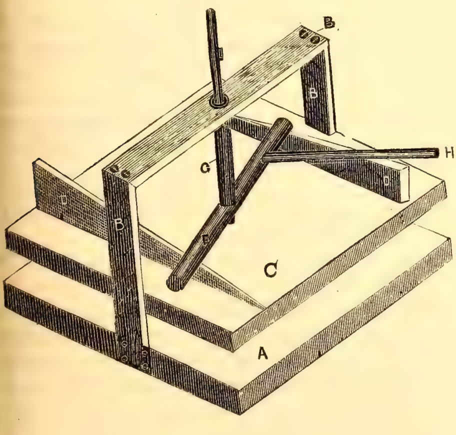


Fig. 2.

For indoor work a press is made as shown in Fig. 2. This press any amateur carpenter can easily construct, it being so simple. The bed A, consists of a stout board of oak or chestnut to which is screwed the framework, B, B, B; between these is a traveling top board, C, C, on the upper side of which are fastened with screws two inclined planes, D, D. The lever, F, travels on the inclined planes when moved by the handle, H, and can be prevented from sliding back by means of pegs inserted in the top edge of the planes, D, D. The traveling top board is kept close to the top of the frame, B, B, B, when not under pressure, by means of two elastic bands. It takes two days in hot weather for the specimens to dry, but in damp weather three, four, and even five, when the specimens are of a gelatinous nature.

When removing the rags great care must be taken not to tear the specimens from the paper. Always begin peeling the rag from the root or disc of the plant.

For mounting there is no better paper than Watman's best drawing paper, as it contains a large amount of sizing, causing the plants to adhere very firmly. For fancy mounting in groups for albums, English or French Bristol board is best.

Be careful in pressing the seaweeds not to put so much pressure that the seaweeds receive an embossed impression of the texture of the rag dryers. Never be in haste to take the specimens out of the press before they are thoroughly dry. Never attempt to hasten the drying by ironing with a hot iron, or placing them in a "slow oven," unless you wish to obtain some deplorable specimens of algology.

Editorial Notes.

Our New Offices.

WE write this in our new offices, at 14 Dey street, to which we have just moved. The new rooms are much more pleasant and convenient than our old offices, and when we get fairly settled we expect to remove many annoyances which cramped quarters entailed on us.

Our new offices are only a couple of doors from the main office of the Western Union Telegraph Company, and about

two minutes walk from the General Post Office, so that our location is central, and as we are only a block or so from a depot of the Metropolitan Elevated Railroad, we are quite accessible.

It may not be out of place to say that from the same office are issued the American Journal of Microscopy, and the American Reprint of the London Lancet.

The Heavens for June.

BY BERLIN H. WRIGHT.

Mercury will not be visible in June.

Venus will present a slightly gibbous phase throughout the month; that is, she will appear like the Moon a few days *after* First Quarter, or *before* Third or Last Quarter. She will be very close to Regulus, the brilliant star in the end of the handle of the Sickle, July 4, being about one degree north of the star. She will be in conjunction with the Moon June 23, being about 4° north. (In the May number, in the reference to the phases of Venus, read *semi-diameter* instead of *diameter*, in all except the first). Venus sets as follows:

June 10—10h. 24m. evening.
" 15—10h. 21m. "
" 20—10h. 18m. "
" 25—10h. 11m. "
" 30—10h. 5m. "
July 5—9h. 57m. "

Mars will be nearly 8° south of the Moon June 12, and on the 30th he will be in conjunction with the planet Saturn, passing so near him as to almost touch his northern limb. When nearest, Mars will be about one-sixtieth degree north of Saturn. Mars rises as follows:

June 5—1h. 10m. morning.
" 10—0h. 59m. "
" 15—0h. 47m. "
" 20—0h. 36m. "
" 25—0h. 24m. "
" 30—0h. 13m. "
July 5—0h. 2m. "

Jupiter becomes an evening star, June 2, being then 90° west of the Sun. He will be about 5° south of the Moon June 10, and stationary July 2. He rises as follows:

June 5—0h. 29m. morning.
" 10—0h. 9m. "
" 15—11h. 47m. evening.
" 20—11h. 28m. "
" 25—11h. 8m. "
" 30—10h. 49m. "
July 5—10h. 30m. "

The following eclipses, transits and occultations of his Satellites are visible in June:

Satellite I.	D.	H.	M.	
Eclipsed, begins	3	3	4	morning
Transit, begins	4	1	45	"
Transit (shad.,) ends	4	2	42	"
Transit ends,	4	4	4	"
Transit (shad.,) begins	11	2	16	"
Transit, begins	11	3	38	"
Occultation, ends	12	3	5	"
Transit (shad.,) begins	18	4	9	"
Eclipsed, begins	19	1	20	"
Transit (shad.,) ends	20	0	57	"
Transit, ends	20	2	17	"
Eclipsed, begins	26	3	15	"
Transit (shad.,) begins	27	0	31	"
Transit, begins	27	1	48	"
Transit (shad.,) ends	27	2	51	"
Transit, ends	27	4	7	"
Occultation, ends	28	1	16	"
Satellite II.				
Transit, ends	2	3	11	"
Transit, begins	9	2	54	"
Transit (shad.,) ends	9	3	4	"
Transit (shad.,) begins	16	2	45	"
Occultation, ends	18	3	21	"
Eclipsed, begins	25	0	26	"
Transit, ends	27	0	5	"
Satellite III.				
Eclipsed, ends	3	4	12	"
Transit, ends	14	3	52	"
Transit (shad.,) ends	20	2	27	"
Transit (shad.,) begins	27	2	48	"
Satellite IV.				
Occultation, begins	14	3	36	"
Transit (shad.,) begins	21	1	16	"
Occultation, ends, (July)	1	0	52	"

At the time of the occultation of Satellite IV. (June 14), the Satellites will occupy the following positions with respect to Jupiter:

Sat. I.—A little more than twice Jupiter's apparent diameter east, and moving from Jupiter.

Sat. II.—A little further west than Satellite I is east, and moving towards Jupiter.

Sat. III.—Upon Jupiter's disc, being in transit, and appearing 16 minutes after the occultation of Satellite IV begins.

Sat. IV.—Will disappear behind the planet at his western limb.

Saturn will be 8° south of the Moon June 13. His near approach to the planet Mars has already been mentioned. He will be 90° west of the Sun July 7, and after that date will be an evening star. June and July, 1879, are the two most favorable months of the year to observe the rings of Saturn. Saturn rises as follows:

June 5—1h. 48m. morning.
" 10—1h. 30m. "
" 15—1h. 10m. "
" 20—0h. 52m. "
" 25—0h. 33m. "

June 30—0h. 14m. morning.
July 5—11h. 51m. evening.

37m., north declination 36° 43'. By referring to a chart of the heavens, it will be seen to be one-

LONG PERIOD VARIABLES.

Date.	*Star's Name.*	*R. A.*	*Declination.*	*Period in Days.*	*Change of Magnitude.*	*Phase.*
June 1.	*S* Virginis.	13h. 26m.	6° 31' —	380.11	6 to 11	minimum
" 3.	*R* Hydrae.	13h. 23m.	22° 47' —	449.5	4 to 10	minimum
" 5.	*U* Herculis.	16h. 20m.	19° 11" +	——	7 to 13	minimum
" 7.	*S* Vulpeculae.	19h. 43m.	26° 59' +	——	7 to 10	maximum
" 13.	*T* Ursa Majoris.	12h. 30m.	60° 13' +	257	6.7 to 13	minimum
" 14.	*T* Aquarii.	20h. 40m.	5° 50' —	197	7.8 to 0	minimum
" 22.	*R* Vulpeculae.	20h. 59m.	23° 18' +	147	8 to 13.5	maximum
" 24.	*R* Persei.	3h. 22m.	35° 13' +	——	9 to 13	maximum
" 26.	*R* Leonis Mino"	9h. 41m.	12° 2' +	312.57	5 to 11.5	maximum
" 29.	*S* Leonis.	11h. 4m.	9° 10' +	192	9 to 13	maximum
" 30.	*R* Virginis.	12h. 32m.	7° 43' +	146	6.5 to 11	maximum

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS FOR MAY 20, 1879.

	H.	*M.*	
Alpha Andromedae (Alpheratz) rises	10	15	even
Beta Persei (Algol) rises	11	55	"
Eta Tauri (Pleiades) rise	2	19	morn
Alpha Tauri (Aldebaran) rises	3	38	"
Alpha Aurigae (Capella) rises	2	6	"
Beta Orionis (Rigel)	invisible.		
Alpha Orionis (Betelguese)	invisible.		
Alpha Canis Majoris (Sirius)	invisible.		
Alpha Canis Minoris (Procyon)	invisible.		
Alpha Leonis (Regulus) sets	10	50	even
Alpha Virginis (Spica) sets	0	50	morn
Alpha Bootes (Arcturus) in merid	8	15	even
Alpha Scorpionis (Antares) in merid	10	26	"
Alpha Lyrae (Vega) in merid	0	41	morn
Alpha Aquilla (Altair) in merid	1	53	"
Alpha Cygni (Deneb) in merid	2	45	"
Alpha Pisces Australis (Formalhaut) rises	0	59	"

EPHEMERIDES OF VARIABLE STARS, JUNE, 1879.

S CANCRI.—*Minimum*—June 15, 8h. 51m. evening, setting at 10h. 5m. evening.

Delta LIBRÆ.—*Minima:*

June 5—1h. 50m. morning.
" 12—1h. 24m. "
" 19—0h. 59m. "
" 26—0h. 33m. "

This star sets, June 18, about 2h. 25m. morn.

U CORONAE.—*Minima:*

June 9—4h. 58m. morning.
" 16—2h. 41m. morning, setting at 5h. 31m. morning.
" 23—0h. 24m. morning.
" 29—10h. 8m. evening.

THE GREAT NEBULA IN HERCULES.—This Nebula is known as 13 Messier; also as Halley's Nebula, having been discovered by Halley in 1714. It is situated in Right Ascension 16h. third of the way from *Eta* to *Zeta;* the two stars which constitute the west side of the quadrilateral in Hercules, situated on a line from Vega to the Northern Crown, and midway between them.

This nebula is visible to the naked eye more easily than the Great Nebula of Orion, described some time since. It is resolvable, and one of the most attractive objects of this class in the heavens. "Perhaps no one ever saw it for the first time without uttering a shout of wonder." Only the most powerful telescopes will entirely resolve this nebula, but a good three-inch glass will resolve the streamers, of which there are six projecting from either side.

Hercules is near the meridian at 9 o'clock in the evening, in June.

Penn Yan, N. Y.

BOOK NOTICES.

Plain Directions for the Construction and Erection of Lightning Rods. By John Phin, editor of the "Young Scientist," and the "American Journal of Microscopy," Third Edition, Enlarged and fully Illustrated. Cloth, 30 cents. New York; Industrial Publication Company.

The season is now approaching when the voice of the lightning rod man will be heard in the land, and thousands of dollars will be spent in putting up rods, three-fourths of which will probably be useless, for it is an unfortunate fact that the average peddler of lightning rods thinks more of the money that he gets than of the protection which he furnishes. Indeed, so common is it for lightning rods to be defective, that many persons have been led to entirely doubt their efficiency, and yet, no fact is more thoroughly established than that a good lightning rod affords perfect protection.

The work before us is the only one within our knowledge that has not been published for the

purpose of puffing some patent; it is short, simple, and fully illustrated, and the practical directions are so full, that any ordinary mechanic can, by following them, put up a really good rod. And it is a comforting assurance to be told that a really good rod need not infringe any patent, the best methods of construction being older than any patents now in force.

The New York Evening Express Almanac for 1879: Handbook of Politics, Statesman's Manual and Statistical Register for Bankers, Merchants and Agriculturists. Price 25 cents. New York: Office of *Evening Express.*

The range of subjects which the compilers of this almanac have compressed into its pages is something astonishing. We have here a goodly volume of nearly 400 large octavo pages filled with important statistics and general information. In addition to the usual matter found in all almanacs, it contains an enormous amount of general information in regard to the products, commerce, politics, geography, education, etc., of almost every country in the world, and all so arranged and condensed as to be easily available at a moment's notice. How all this can be done for 25 cents is one of the marvels of bookmaking.

Green Varnish.

There is a most beautiful transparent green varnish employed to give a fine glittering color to gilt or other decorated works. As the preparation of this varnish is very little known, an account of it may in all probability prove of interest to many of our readers. The process is as follows:—Grind a small quantity of a peculiar pigment, called "Chinese blue," along with about double the quantity of finely-powdered chromate of potash, and a sufficient quantity of copal varnish thinned with turpentine. The mixture requires the most elaborate grinding or incorporating of its ingredients, otherwise it will not be transparent, and therefore useless for the purpose for which it is intended. The "tone" of the color may be varied by an alteration in the proportion of the ingredients:—A preponderance of chromate of potash causes a yellowish shade in the green, as might have been expected, and *vice versa* with the blue under the same circumstances. This colored varnish will produce a very striking effect in japanned goods, paper-hangings, &c., and can be made at a very cheap rate.—*Cabinet-maker.*

Nickel Plating.

A foreign exchange gives the following recipe: To a solution of five to ten per cent. of chloride of zinc, as pure as possible, add sufficient sulphate of nickel to produce a strong green color, and bring to boiling in a porcelain vessel. The piece to be plated, which must be perfectly bright and free from grease, is introduced so that it touches the vessel as little as possible. Ebullition is continued from 30 to 60 minutes, water being added from time to time to replace that evaporated. During ebullition nickel is precipitated in the form of a white and brilliant coating. The boiling can be continued for hours without sensibly increasing the thickness of this coating. As soon as the object appears to be plated it is washed in water containing a little chalk in suspension, and then carefully dried. This coating may be scoured with chalk, and is very adherent. The chloride of zinc and also the sulphate of nickel used must be free from metals precipitable by iron. If during the precipitation the liquor becomes colorless, sulphate of nickel should be added. The spent liquor may be used again by exposing to the air until the contained iron is precipitated, filtering and adding the zinc and nickel salts above. Cobalt also may be deposited in the same manner.

Plaster of Paris.

Plaster of Paris may be made to set very quickly by mixing in warm water to which a little sulphate of potassium has been added. Plaster of Paris casts, soaked in melted paraffin, may be readily cut or turned in a lathe. They may be rendered very hard and tough by soaking them in glue-size until thoroughly saturated, and allowing them to dry. Casts of plaster of Paris may be made to imitate fine bronze by giving them two or three coats of shellac varnish, and when dry applying a coat of mastic varnish, and dusting on fine bronze powder when the mastic varnish becomes sticky. Rat-holes may be effectually stopped with broken glass and plaster of Paris. The best method of mixing plaster of Paris is to sprinkle it into water, using rather more water than is required for the batter; when the plaster settles pour off the surplus water, and stir carefully. Air bubbles are avoided in this way.—*Scientific American.*

Splitting Paper.

It is one of the most remarkable properties of that wonderful product, paper, that it can be split into two or even three parts, however thin the sheet. We have seen a leaf of the *Illustrated News* thus divided into three parts, or three thin leaves. One consisted of the surface on which the engravings are printed; another was the side containing the letter press, and a perfectly blank piece on each side was the paper that lay between. Many people who have not seen this done might think it impossible; yet it is not

only possible, but extremely easy, as we shall show.

Get a piece of plate glass and place on it a sheet of paper; then let the latter be thoroughly soaked. With care and a little dexterity the sheet can be split by the top surface being removed. But the best plan is to paste a piece of cloth or strong paper to each side of the sheet to be split. When dry, violently and without hesitation pull the two pieces asunder, when part of the sheet will be found to have adhered to one and part to the other. Soften the paste in water and the pieces can be easily removed from the cloth.

The process is generally demonstrated as a matter of curiosity, yet it can be utilized in various ways. If we want to paste in a scrap-book a newspaper article printed on both sides of the paper, and possess only one copy, it is very convenient to know how to detach the one side from the other. The paper when split, as may be imagined, is more transparent than it was before being subjected to the operation, and the printing ink is somewhat duller; otherwise the two pieces present the appearance of the original if again brought together.

Some time ago the information of how to do this splitting was advertised to be sold for a considerable sum. We now impart it to all our readers gratuitously.—*B. and O. Printer and Stationer.*

Practical Hints.

Cleaning Brass.—Finely rubbed bichromate of potash mixed with twice its bulk of sulphuric acid and an equal quantity of water, will clean the dirtiest brass very quickly.

Marine Glue.—The following recipe is said to give very good results: Dissolve one part of India-rubber in 12 parts of benzole, and to the solution add 20 parts of powdered shellac, heating the mixture *cautiously* over the fire. Apply with a brush. This is much used in the construction of galvanic batteries.

To Restore Spotted Varnish.—If the varnish has been blistered by heat or corroded by strong acids, the only remedy is to scrape or sandpaper the article and revarnish. Spots may often be removed by the following process: Make a mixture of equal parts of linseed-oil, alcohol, and turpentine, *slightly* moisten a rag with it, and rub the spots until they disappear. Then polish the spot with ordinary blotting paper. Varnish injured by heat can hardly be restored in any other way than by removing it and applying a fresh coat.

To Make Iron Take a Bright Polish Like Steel.—Pulverize and dissolve the following articles in one quart of hot water: Blue vitriol, one ounce; borax, one ounce; prussiate of potash, one ounce; charcoal, one ounce; salt, one half-pint; then add one gallon linseed oil. Mix well, bring your iron or steel to the proper heat and cool in the solution. It is said the manufacturers of a certain governor paid $100 for this recipe, the object being to case-harden iron so that it would take a bright polish like steel. We regard the process as one of questionable utility.

Cements.—To make cement for attaching labels to metals, take ten parts tragacanth mucilage, ten parts of honey, and one part flour. The flour appears to hasten the drying, and renders it less susceptible to damp. Another cement that will resist the damp still better, but will not adhere if the surface is greasy, is made by boiling together two parts shellac, one part borax, and sixteen parts water. Flour paste to which a certain proportion of nitric acid has been added, and heat applied, makes a lasting cement, but the acid often acts upon the metals. The acid converts the starch into dextrine.

Potassium.—The metallic appearance of potassium is usually exhibited by cutting a fresh surface which is immediately examined. But the surface becomes dim almost instantly. As a lecture experiment, Dr. Erckmann, introduces a piece of potassium, of the size of a pea, into a small test tube, heats to fusion, turns the glass round and round till the metal congeals, and then seals up the tube. The greater part of the potassium is deposited on the sides of the tube as a specular metallic coating, resembling silver, and can be exhibited during lectures, etc. The other alkaline metals may be similarly treated.

To Protect Iron from Rust.—Iron can be protected from rust and made very pleasing in color by a method invented by Mr. Dode. He coats the surface with a thin film of borate of lead, in which some oxide of copper has been dissolved, and some scales of precipitated platinum held in suspension, by means of a brush or a bath. He then heats the composition until it is diffused. The result is a thin, glassy coating, which will withstand the action of sewer gases, dilute acids or alkalies, and the heat of a kitchen fire. If all be true that is said of this "platinized iron," as it is called, it will find numerous applications.—*Kansas City Rev. of Sci. and Ind.*

Glue.—Carpenters should remember that fresh glue dries more readily than that which has been once or twice melted. Dry glue steeped in cold water absorbs different quantities of water according to the quality of the glue, while the proportion of the water so absorbed may be used as a test of the quality of the glue. From careful experiments with dry glue immersed for twenty-four hours in water at 60° Fah., and thereby transformed into a jelly, it was found that the finest ordinary glue, or that made from white bones, absorbs twelve times its weight of water in twenty-four hours; from dark bones, the glue absorbs nine times its weight of water; while the ordinary glue, made from animal refuse, absorbs but three to five times its weight of water.—*Building News.*

EXCHANGES.

A Smith & Wesson automatic ejector revolver, key check and stencil plate outfits, wanted for a combination saw, lathe, &c. Thos. D. Adams, Lock Box 61, Franklin, Pa.

J. T. Bell, Franklin, Pa., has brass condensing and exhausting air syringe, 100 good specimens (75 lbs) mostly silver ore, to exchange for gun, telescope, magic lantern, music box, or offers.

Wanted, back No.'s of the YOUNG SCIENTIST (for 1878), for a good dark lantern, cost $1.25. G. U. Bigelow, Palmyra, N. Y.

Duplicate collections of sea mosses from Oregon coast, for eye-glasses, back No.'s YOUNG SCIENTIST, or paper (working) pattern of best puzzle. Theo. Boone, Oneatta, Benton Co., Oregon.

Wanted, a microscope with accessories, in good condition, worth $5 or $10; state what is wanted in exchange. Will. H. Brewster, Middlebury, Vt.

Three vols. of Frank Leslie's Boys and Girls Weekly, cost $2.50 vol., to exchange 6 months for vol. 1 of YOUNG SCIENTIST, the rest for good books on electricity and science. Walter M. Brown, Owen Sound, Ont.. Canada.

Wanted, book, "Corner Cupboard or Facts for Everybody," in exchange for a card printer and type. H. E. Burnham, 176 Adams Ave. E., Detroit, Mich.

State what will be given for 250 foreign stamps, all different; list of other stamps sent on application. C. E. Chegwidden, 140th street, Mott Haven, N. Y.

Wanted, in exchange for good guitar, cost $25, a stationary engine, or bracket saw and turning lathe combined, or offers. Frankie Park, Dodge's Corners, Waukesha Co., Wis.

I have a magic lantern with 35 slides, cost $5; would like to exchange it for almost anything of similar value. Address all offers to C. Von Eiff, Box 4,465, City.

Fine carbine rifle, loads from muzzle or breech, in good condition; will exchange it for a double barrel shot gun, watch, or small rifle with bore 22-100. The Editor's Eye, 209 Rhodes Ave., Chicago, Ill.

Wanted, to exchange, North Carolina minerals, shells, stamps and Confederate money, for minerals, archæological specimens, Indian relics, vertebrate and invertebrate fossils, and curiosities for my museum. Robert H. Engle, Box 325, Raleigh, N. C.

Three volumes of Oliver Optic's (Wm. T. Adam's) works, Seek and Find, Fighting Joe, and The Yankee Middy, exchanged for cabinet mineral specimens. Anthony Garner, P. O. 53, Ashland, Pa.

To exchange, a seven shooting revolver of best make, in good condition, size of bore 22-100 in.; state what is offered in exchange. H. V. H., P. O. Box 47, Coeymans, Albany Co., N. Y.

Fairbank's No. 1 chemical scales and weights, cost $15, for a bracket saw with or without lathe attachment; scales warranted perfect; will give a *good* trade. Samuel J. Jones, Box 137, Oxford, N. C.

Wanted, double-barrel shot-gun or scroll saw, in exchange for telegraphic key and sounder on one base, Craig microscope, etc. C. H. Jordan, Shimersville, Lehigh Co., Pa.

Unmounted microscopic objects such as foraminifera, spicules, starches and parts of foreign insects, &c., to exchange for other mounted or unmounted objects. S. N. Hardy, Victoria, Cass Co., Neb.

A complete outfit for making chromo photographs and a small magic lantern and slides, worth $10, for a 5x7 printing press, or type, or a combination scroll saw and lathe. Geo. L. Lamson, La Fargeville, N. Y.

An oscillating steam engine, 1-inch bore, 2-inch stroke, to exchange for a household microscope, or offers. L. E. Kent, Santa Ana, Los Angelos Co., Cal.

Lippincott's, $4.00; Popular Science, $5.00; Phrenological, $2.00; Sanitarian, $3.00; Library, 3 copies $1.00 each; Housekeeper, $1.00; all monthlies, 1879, complete; Daily Sun, N. Y.; Star, Cincinnati, 1 year, $5.00; make offers. C. H. Kimball, Plymouth, N. H.

Wanted, correspondents to exchange insects with; will send full instructions for capture and make liberal exchanges. C. W. L., Box 3,565, N. Y. City.

Choice cabinet mineral specimens, for historical, scientific, masonic or other instructive books. C. A. Leeper, Bonanza City, Lemhi Co., Idaho.

To exchange, certificate for a course of lessons in shorthand writing, for books, or offers; also copies of the Student's Journal, for copies of YOUNG SCIENTIST; state what numbers you can furnish. H. C. Lucas, Macomb, Ill.

Wanted, all numbers of the YOUNG SCIENTIST for 1878, in exchange for the Story of a Bad Boy, or Chance for Himself; each cost $1.25. Jesse H. McIntire, Rockport, Mass.

Wanted, Queen's or McAllister's Household microscope; specimens of insects, woods, &c., in exchange; or state what is wanted. W. C. McNaul, Salina, Clinton Co., Pa.

Minerals, fossils, Indian relics and foreign stamps wanted, in exchange for same, or for greenhouse plants. Send list to Wm. J. Morgan, Somerville, N. J.

Wanted, a good wood lathe with attachments; state what is wanted in exchange, giving description of lathe. C. W. Munson, Nashville, Tenn.

Wanted, printing press, for a scroll saw and tools for finishing work. T. H. Nicholson, 14 East 127th St., N. Y. City.

To exchange, a novelty printing press, type and accessories, for a microscope with accessories, or minerals, or offers. T. W. Patterson, Warsaw, N. Y.

Wanted, a small printing press, Model or Novelty preferred, in exchange for a French microscope, objects and accessories, worth $20. C. L. Peticolas, 635 8th St. North, Richmond, Va.

Wanted, stereo camera with lens, ½ size view camera and lens, photo chemicals or offers, for rosewood writing desk inlaid with mother of pearl, and complete rosewood box of drawing instruments. A. B. Porter, 501 North Tenn. St., Indianapolis.

Wanted, a turning lathe from ½ to 2 inches swing; state what is wanted in return. Grant Price, Lock Box E, Cherokee, Crawford Co., Kan.

Wanted, a good set of engravers tools and a book of instruction, in exchange for an aquarium. H. E. Rhodes, Brighton, Iowa.

Wanted, to exchange, books for type; send specimen of printing of type; also state weight of font &c. J. Siler, 1,242 Broadway, St. Louis, Mo.

To exchange, a new book on fret sawing and wood carving, well illustrated and very handsomely bound, for good mineral specimens; also coins to exchange for minerals, &c. A. H. Spencer, East Clarendon, Vt.

Wanted, a good microscope or a pair of telephones, or other apparatus, in exchange for a photographic camera, lens, plate-holder, tripod, &c., valued at $5, entirely new, and enclosed in a neat case. Sheldon Sperry, 99 Lee Ave., Brooklyn, E. D., N. Y.

A collection of foreign and U. S. stamps, some paints and colored pencils, in exchange for Indian relics. Sherman Sweeting, South Butler, Wayne Co., N. Y.

A strong magnet, in exchange for Indian relics. Sherman Sweeting, South Butler, Wayne Co., N. Y.

The Young Scientist

SCIENCE IS KNOWLEDGE. — KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL FOR AMATEURS.

VOL. II. NEW YORK, JULY, 1879. No. 7.

How I Made my First Telescope.

BY W. B. HARRISON.

"HOW much we need a telescope to show us all these wonderful things," said our teacher to the class in Astronomy, at the close of a lesson, the subject of which was the planet Saturn.

"Where can we get one," timidly asked one of the scholars.

"I do not know," dreamily answered the teacher.

"Does a telescope cost much," asked another, and the same dreamy "'I don't know;' perhaps several hundred dollars," was the reply. The teacher then drew on the blackboard the form and combination of lenses of the common refracting telescope, closing with the remark that the principle of this telescope was very simple.

"Why couldn't we make one then," I suggested, warmed by the subject, but a sneer as the class took their seats, told me that I had ventured too far.

In the country school of New England, where this scene occurred, about thirty years ago, a half dozen of the larger scholars had formed a class in Astronomy and were using "Burritt's Geography of the Heavens" as a text book. They were plodding along somewhat blindly, with a teacher who knew but little of the science he tried to teach.

The sneer that greeted my suggestion, stung pretty deep, and at the same time aroused my ambition to possess a telescope. The diagram drawn by the teacher floated before my eyes. The more I thought of it, the more simple seemed the instrument. Where to get the lenses and fixtures was the trouble. By a careful reading of the Natural Philosophy we then used (Olmsted's Rudiments), I learned that only two lenses need be used for the telescope I wanted. The image formed at the focus of the larger lens, being magnified by a smaller lens placed behind this image. It was all very simple, surely.

I lay many, many evenings after this, looking at the stars through my bed-room window, and racking my brain how to get those lenses, for I was determined to have a telescope and to build it myself. In those days we had no YOUNG SCIENTIST to which we could refer for information, or to ask

where to get such things as telescope lenses. I made, what was to me, a desperate effort. I wrote to the editor of a New York paper, somewhat doubtful of a reply, asking him about the prices of lenses. A few days brought an answer and price list from an optician in Broadway. The prices were much lower than I expected, and I found that for about five dollars I could get two lenses, one of three inches diameter and three feet focus, and another of one inch diameter and one inch focus.

All through that spring and summer, I saved and hoarded pennies and shillings to purchase the coveted glasses. But to a boy of fifteen, in those days, especially when kept upon a farm, the opportunity to get money was limited. I dare not tell my project to any one, for if it were known that I intended to build a telescope, I would become a subject for ridicule. Telescopes were only made by expert mechanics, and at that time were only then used in colleges and similar learned institutions.

From spring to fall my little store of money increased, until I had enough saved to make the purchase. A man who kept a small store, near where I lived, was going to New York to buy goods. I told him my secret, gave him my money and the price list of lenses. In a few days he returned. My daily task being completed, in the evening I hastened to his house and obtained the coveted purchase. How my heart beat as I removed the last paper and the two glasses lay before me. I looked at them, turned them over, held them in my hands as they would be if placed in a tube, used them as eye glasses, etc., and after spending the entire evening looking through them, went to bed and slept with them under my pillow. In the morning I hid them in my trunk and spent the day contriving how to make the tubes.

I decided that paper would suit my purpose best, so I made a rough wooden cylinder a little more than three inches in diameter and a little more than three feet long. I turned this in a rude foot lathe I had made. I wrapped some thick paper around this cylinder and over this pasted three or four layers of paper, taking care to paste it smooth and even. When these were thoroughly dry, I put on three or four thicknesses of paper fastened with glue. Over this I pasted other layers, and when dry I found it made a light and strong tube. I painted the interior black with a mixture of lampblack and turpentine. I then made a tube about one inch long and small enough to go inside the large tube. I put this in my lathe, and with a sharp chisel cut it in halves, making two narrow rims or rings of it. One of these I put in one end of the large tube, about an inch from the end, and glued it there. I put in the lens, and then put in the other ring to hold it there, and glued it also. I fitted a paper cap over the end so as to protect the lens from dust or injury.

At the other end of the tube, a little more than three feet from the lens, I glued a piece of wood, turned to fit, and made a hole in it a little larger than my small lens. I made a small paper tube to fit this hole pretty tight, and fitted in the small lens and fastened it at one end in the same way that I had fastened the large lens. My instrument was now done, and I waited for evening to test its powers. That my heart beat quick when I raised it to take my first look at the heavens, is no exaggeration.

I found I could see quite well the hollows of the mountains in the moon, and could distinguish the shadows cast by the mountains. The crescent of Venus distinctly showed, and I could make observations on the satellites of Jupiter.

In using it for land objects, everything appeared inverted, but I soon got used to this, in fact I cared little for it, as I valued it most for astronomical observations.

I sadly wanted a stand for my telescope. I fastened a piece of wood about a foot long, lengthwise of the tube, and about midway from each end. Set in a groove that run lengthwise with the wood was a piece of brass about as thick as a card. It was fastened by screws put in crosswise through both wood and brass. That part of the brass that projected from the wood was nearly circular, about two and a half inches in diameter, with a hole through the centre. The top of an old fashioned

bed post about two feet long made the upright of my stand, and a cleft cut with a saw received the brass circle. A bolt passed through the upright and through the hole in the brass when they were put together. By tightening the nut to the bolt, I could hold the tube in position, yet it would tip up or down by using a little force. In the lower end of the upright, I bored a hole and drove in a piece of iron rod about three-eighths of an inch in diameter. A hole bored in the window sill received the projecting end of this rod. So far my stand answered very well. I could mount it at my window, tip the tube up or down and from side to side, and have a pretty fair view. But if I wished to move my instrument, I had no stand on which to place it. There was in my room an old fashioned round stand, with three feet to stand on the floor and an upright to which was attached the top. In this top or table I bored a hole to fit the rod, and put my telescope on the stand, the same as I had placed it on the window sill. I had now as good a stand as I could wish for.

In the evening, when making observations, I could place a candle upon the stand, and beside it I could have my books and papers. In this respect it was better than any stand I have since used.

It so happened that I never again attended the class in Astronomy, and the gratification which I expected to have when I could offer my telescope to the class, to view the wonders of the Heavens, I never realized. But when it became known that I really had made a telescope, I was beseiged with visitors to have a look through it, and when explaining the cost, and how I made the instrument, the expressions of surprise and wonder were more than sufficient to repay the pain caused by the sneers of the class, when I ventured to suggest that perhaps we could make a telescope.

Engraving on Wood—V.

BY SARAH E. FULLER.

HAVING cut the first block, place a small quantity of ink upon the slab, and, with the dabber, beat it until it is very fine. Then lightly beat the block, allowing the dabber to remain a few seconds at each beat. By carefully inking a cut, the exact quality of the engraving is perceived. In this first lesson, the character of the lines is shown very plainly. Some lines, probably, will be found thicker in one portion than in another; some will seem to have lumps on them, and some will have been cut too thin. If such is the case, it will not be possible to make this tint perfect, but with care it may be much improved. The lines that are too thin must be let alone; they cannot be mended. From the thick and lumpy lines, with a tool several degrees finer than the one with which the tint was cut, take off a slight shaving, now on the upper and now on the lower side, being careful not too take off too much, and so make the line too thin. When stops occur, turn the block downwards, and, with the same tool with which the tint was cut, re-enter the line, and cut the space of wood left, almost through to the end of the line

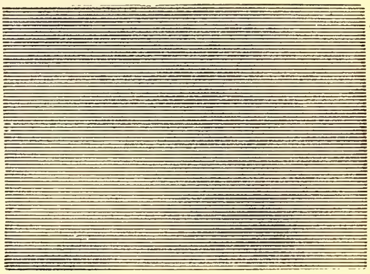


Fig. 16.

as it stopped. Then, with a fine tool, cut the remainder of the little stop of wood through on each side of the end of the lines, being careful not to make the ends of the lines too fine. When well done, the color of the tint will scarcely be disturbed by the meeting of the two series of lines; and it is always better to stop, and begin again, than to cut crooked lines.

And there will often be occasions when it will be necessary to unite tints, cut with different-sized tools, in this same manner. After trimming the lines of the tint as much as is necessary, ink the block again in the manner described, cut a piece of India proof paper, and lay it carefully

upon the block. With an ivory paper-knife, rub gently over the paper, pressing only sufficiently to make the ink adhere to the paper. Rub in the direction the lines are cut. Do this in all cases if possible. Light and delicate lines must be rubbed more gently than heavy lines; and, when printed, the press should be so adjusted that there will be less pressure upon them than upon the heavy lines. It is as it is technically called, than in the previous examples. After success is attained in producing plain tints, proceed with graduated tints, which are made by varying the width of the lines, and their distance from each other, as in Fig. 18. After facility is obtained in straight-line tints, proceed to the study of waved lines. Cut some lines which are slightly waved, as in Fig. 19. This kind of line will be

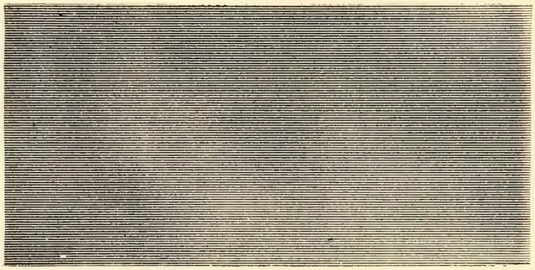


Fig. 17.

Fig. 18.

advisable to preserve proofs of work from the beginning, as they mark the progress of the individual, and they are always useful for reference.

For a second lesson, take a block (Fig. 16) somewhat larger than the first, and cut some similar tint. Proceed carefully, and be in earnest to make straight lines, and do not give up the practice till straight lines and an even tint are produced. The use of different-sized tools will give variety in the tint-studies. Also, with the same tool, cut lines with surface, and those that are sharp.

The next example, Fig. 17, is cut with a finer tool, and has more surface, or *face* found very useful in sky-tints. Afterwards cut some with more undulation of line, and some lines quite curved, as in Fig. 20. It should be observed, however, that it is not desirable to cut *masses* of tint with this line; for, "when the alternate undulations are much curved, the tint, when printed will appear as if intersected from top to bottom, like wicker-work, with perpendicular stakes." "This effect will be observable, both in lines cut by hand and by machine."

Examine fine examples of wood engraving, and observe closely the tints, and endeavor to imitate them; and continue the studies of tint-cutting till the pupil can

cut tints skilfully. Remember that future success depends upon the manner in which these first lessons are cut. When able to cut tints well, take a small picture which is made principally of tints. In a drawing on wood, the lines to express the given effects are cut according to the judgment of the engraver. In a transfer, all the lines are transferred to the wood just as they are to be cut. Hence transfers, at this stage of the pupil's progress, are most serviceable for practice.

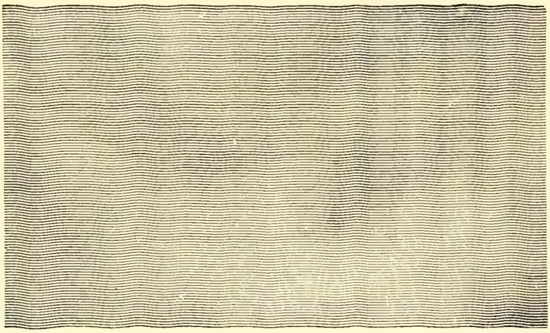


Fig. 19.

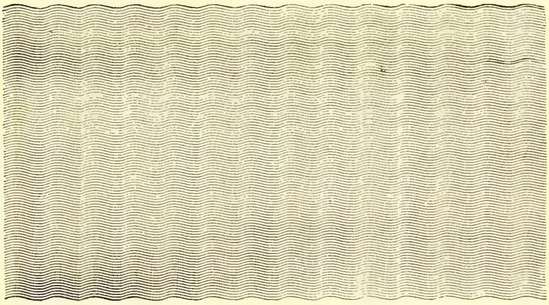


Fig. 20.

Scroll Sawing—III.

BY F. T. HODGSON.

By an examination of Fig. 12, it will be seen how saws are graded for sizes; they can be bought for about ten cents a dozen for the cheaper sort, and from twenty to thirty cents a dozen for the best qualities.

In choosing saw-blades, it is best to take only those that have sharp and regularly cut teeth. No.'s 0, 00, and 000, are very small and fine, and are used only for the finest of work, such as inlaying, cutting the veins of leaves, or turning small circles. The saws numbering from one to six are the best sizes for general work, as the smallest can be used for nearly all purposes of fine work, and the largest is strong enough for any work the amateur will care to undertake with a saw operated by hand. The finest saw blades have teeth so fine that they are scarcely visible to the eye, and make a cut or "kerf" so narrow that a slip of the paper of this book would fill it; they require no set, and are never sharpened, and can be used until they get broken, which is their natural end. For hand sawing the numbers 0 and 1 are the best sizes to use, unless very delicate work is required, when the finer numbers may be employed.

As before stated, the capacity of the

hand saw is limited, its work is slow and tedious compared with the foot-power machine, and the more delicate kinds of work, such as inlaying and mosaic, can not be done with it satisfactorily; yet, there is much in the hand frame besides

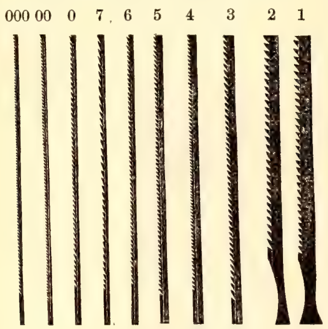


Fig. 12.

its cheapness, that will always recommend it as a good tool for boys to begin with.

There can be no question, where a foot-power machine can be afforded, but that it is the best; and that there are degrees of perfectness in treadle saws, is as true as that there are differences in hand-frame saws; and a bad, loose jointed, ramshakle foot machine, should above all things be avoided, for they are sure to lead to disappointment and loss of time, material and temper.

There are many machines in the market, good and cheap, capable, in good hands, of doing the finest of work; and a little judgment employed in the selection when about to purchase, will save a great deal of trouble and annoyance afterwards. If you have not set your mind on obtaining some particular make, or had some saw recommended by a friend in whom you have confidence, it would be well to send to the different dealers for circulars, and thereby make yourself acquainted with the worth and capabilities of each make before buying, always bearing in mind that a saw for which a small sum of money is paid, may turn out to be a very dear one in the end. However, if you purchase from any of the noted makers, you may rest satisfied that you have got the worth of your money.

Having procured your saw, the next thing is to use it, and here let me say, that in fret-sawing, like everything else of use, there is no royal road to perfection; it will be necessary for you to proceed step by step. You must not expect to cut elaborate brackets or intricate leaf work, on the very day you get the saw. In order, however, to lead you on as rapidly as possible to a point where results can reasonably be expected, I purpose to give you a few hints accompanied by the necessary illustrations; but before doing so, it will not be out of place to say a few words regarding the material which will be necessary to use in the initiatory exercises about to be gone into. As satisfactory results are not expected from these first beginnings, it would be foolish to waste expensive materials while practicing; therefore, the operator should lay in a supply of empty cigar boxes, which should be taken apart, and all the nails carefully withdrawn; the pieces should then all be laid together and a weight placed on the top to keep them from warping. The wood in these boxes, which is Spanish cedar, is excellent for the amateur to begin sawing with, as it is soft and easily worked. The paper can be taken off by soaking the pieces in water a few minutes, and then scraping them, after which the wood should be placed on end to dry, which it will do without warping. When the wood is dry, it should be rubbed with fine sandpaper, after which it is ready to receive a design for the first attempt.

Mark, with a lead pencil, on one of the prepared pieces of wood, lines as shown in Fig. 13, commencing with the saw at A, running down to the intersection, then changing the direction of the saw so that

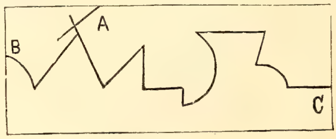


Fig. 13.

it cuts the line as far as the angular point, then change direction again and follow the line cutting out at B. Begin again at A, and follow the lines closely until the saw cuts through at C. Be sure and have all the angles sharp and well defined; for

in fret-work, nothing looks worse to the trained eye than the points of angles nipped off, or left ragged and slovenly done. Repeat this operation at least a dozen times, or until you can saw one that has all the angles and corners clear and bold. When this is accomplished, then attempt the cutting of Fig. 14, which is a little

Fig. 14.

more difficult. To cut this, start the saw at A, then run up to the point and a little further, then turn the piece around so that the saw will *take* at the point without spoiling the sharpness of the angle. The other points will require the same treatment, until B is reached.

Fig. 15 will perhaps be found more difficult at first to cut, than the two previous examples; for it is a curious fact, that straight lines are more difficult to follow

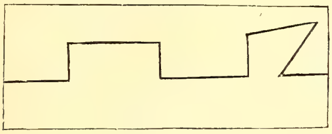


Fig. 15.

by the beginner than curved ones; the learner, however, should make it a point not to lay this example aside, until he can follow the lines exactly and leave all the angles sharp and clear.

Fig. 16 shows a series of curves, which may be next undertaken. This example

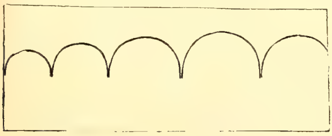


Fig. 16.

presents no particular difficulty; the junction of the curves will require a little care in getting them clear, sharp, and uniform.

Lessons in Magic.—IX.

Fresh Laid Eggs.

THE conjurer orders his assistant to bring a plate, which being done, he bids him hold it, and then approaching, taps him gently on the head; immediately he opens his mouth and there appears an egg.

The performer takes this out of his mouth, puts it on the plate, and then passing behind him, goes to his other side, taps him again on the head, and another egg appears. So he continues until he has six or more eggs, which he then prepares to hatch.

Before proceeding further, however, I will explain how the eggs are produced.

When the assistant goes for the plate, he puts an egg in his mouth and keeps it concealed there; the performer holds another egg palmed in his left hand. With his right hand he taps his assistant on the crown, who then allows the egg to appear at his mouth, and when the performer puts his left hand up to take it, it is drawn into the mouth again, whilst the one in the performer's hand is shown to the audience, who suppose it has just been taken from the mouth. This egg is laid on the plate, which the assistant holds, and as the performer passes behind him to cross to his other side, he takes a second egg from under his waistcoat and conceals it in his palm, as he did the first.

In this way he can take out as many as he wants. The last one, however, the assistant lets drop from his mouth on to the plate, and by this movement sets at rest any suspicion that the audience might have that the eggs did not come from his mouth.

The Patent Incubator.

"Now that I have these eggs, ladies and gentlemen," the conjurer says, "I will show you another very wonderful trick, which is no less than my patented method of hatching chickens. I will need, however, to borrow four or five finger-rings from the ladies, which my assistant will try to collect."

The assistant goes amongst the audience and requests those ladies who will favor him with their rings, to place them on a

piece of brass wire, about two feet long, which he holds by one end in his right hand. The object of this wire, he explains, is, so that he may not be suspected of changing the rings. Having borrowed three or four, he returns to the stage and hands the wire to the performer, who counts them aloud, "One, two; ah, I see that is an engagement ring, with a solitaire diamond; really, I ought to be very proud, Miss, at being so favored. Three; a plain gold, wedding ring. Four; well, number four may be gold, but I must say it looks very suspicious. However, I will return only what I receive."

He next takes a pistol with a large barrel and places the rings, one after another, in it.

"Number four, seems a trifle too large, to go in here," he says, "but as I doubt it's being gold, I will have no hesitation in shaping it so as to fit."

As he says this, he takes a hammer and batters the ring until it is flat, when he puts it into the pistol.

The pistol, he puts where it can be seen by all, and then brings out a deep saucepan, which he allows every one to examine.

Into this pan he puts four of the eggs which are on the plate, and then pouring spirits on them, sets it on fire.

"This is the way," he says, "that they cook eggs in Japan, I am told, but at any rate 'tis the way I cook in my pan. Quick, bring me the cover."

The assistant brings the lid; the saucepan is covered, handed to the assistant, and the performer, seizing the pistol, fires it at the pan. Bang! it goes; the cover is removed from the pan, and instead of the eggs there are four doves, each bearing a ring tied to its neck by a ribbon. The doves are carried to the owners of the rings, who are allowed to cut the ribbons from their necks, so that the rings can not in any way be changed.

For this trick, is needed four brass rings, four eggs which have been "blown," that is, their contents extracted by means of a little hole at each end; and a pistol, and a saucepan of peculiar construction.

The pistol is made with a small, narrow barrel, into which the powder and wad are put, and on top of this barrel is another and larger one, not connected in any way with the stock. It is in this, that the rings are put, but from the other that the charge is fired, though of course the audience must not be allowed to suspect this.

The saucepan is double; that is, there is one pan fitting into another, the inside one, however, having no handle. The lid fits into this inside one, and it is in this that the doves are placed by the assistant.

The rings are changed by the assistant, as he passes back to the stage, after collecting them, by merely letting those that are on the wire drop into his left hand, whilst brass ones to take their place, are dropped on to the wire from his right hand. This trick always pleases the ladies.

It sometimes happens that when a party of friends get together, the amateur conjurer is called upon to show some of his tricks, and on such an occasion, being entirely unprepared, he is at a loss what to do. In such an event, he has to depend entirely upon his manual dexterity, and press into his service such articles as are most readily obtained. If any of my readers are ever caught in this fashion, I would suggest as a suitable trick, that of

Telling the Court Cards by the Touch.

This little trick is only suitable for a small party, and according to the old-fashioned method, could only be performed before a party seated at table.

You inform the company that you propose to pick out the court cards by merely feeling them; that you will allow your eyes to be blindfolded, and that there may not be any suspicion of an arrangement of the pack, it may be thoroughly shuffled.

A handkerchief is accordingly placed on your eyes, and you proceed to do just what you promised, which is no very difficult matter, as your opposite neighbor, by a previous agreement made with you, presses your foot with his, when you come to the court cards.

But that trick is old, and the chances are, that if there be twenty persons present, fifteen will know how it is done, and then will follow any amount of "chaff" at the expense of the performer and his assistant.

But there is another way of doing the trick, which is not generally known, and appears quite incomprehensible.

Begin the trick in the old way, by having some arrangement with one of the parties present, who is, we will suppose, to cough, or give some other sign the moment you arrive at the cards you want.

Make as much flourish as possible, in showing the trick, and the probability is, that before you have been at it many moments, the company will begin to understand the means you employ. Then will follow laughter, probably a sneer. Notice none of these, but suggest that "some of you may have seen this trick before, but my manner of doing it is entirely new."

"Very new," some ill-natured fellow will say, "why, that is the identical method practiced by Noah for sorting the cards before placing them in the Ark. Do you suppose that we are all so dumb that we can't understand that most painful cough of our friend Makeshift?"

The company will of course smile at this; if rude, they may laugh, and some will advise you to learn some newer trick.

Their triumph, however, is but short lived, for turning toward them with a half reproachful air, and draping yourself majestically in the folds of your coat, you thus address them:—

"Gentlemen, I am sorry to find that you think so meanly of my magical acquirements as to suppose I would impose upon you by such a miserable trick. As the best means, however, of controverting your opinion and proving to you how you have wronged me, I will mount a chair in the middle of the room. First of all, examine the pack and shuffle it well."

And then to their great astonishment, you place the pack behind your back, and in a few moments sort out all the court cards.

In order to do this, the cards must have been previously prepared as follows: Taking the court cards, you run the point of a knife along the edge of the card, first at one end and then at the other—mind, not on the face, nor the back, but the edge. This will make a furrow, which can be easily felt by the fingers. When you take hold of the cards, you pretend to feel the centre with the thumb and fore-finger, but allow the tip of the little finger to come to the edge, and you will have no difficulty in discovering the cards. The furrow is so trifling that even when closely examined, it will not be noticed, especially if the pack be an old one. While doing the trick, hand the pack every little while to be shuffled, as that tends to lull suspicion.

Coloring and Finishing Brass-Work.

To prevent the every-day rusting of brass goods, the trade has long resorted to means for protecting the surface from the action of the atmosphere, the first plan of which is to force a change to take place. Thus, if brass is left in damp sand, it acquires a beautiful brown color, which, when polished with a dry brush, remains permanent and requires no cleaning. It is also possible to impart a green and light coating of verdigris on the surface of the brass by means of dilute acids, allowed to dry spontaneously. The antique appearance thus given is very pleasing, and more or less permanent. But it is not always possible to wait for goods so long as such processes require, and hence more speedy methods became necessary, many of which had to be further protected by a coat of varnish. Before bronzing, however, all the requisite fitting is finished and the brass annealed, pickled in old or dilute nitric acid, till the scales can be removed from the surface, scoured with sand and water, and dried. Bronzing is then performed according to the color desired; for although the word means a brown color, being taken from the Italian "*bronzino,*" signifying burnt brown, yet in commercial language it includes all colors.

Browns of all shades are obtained by immersion in solutions of nitrate or the perchloride of iron; the strength of the solutions determining the depth of the color. Violets are produced by dipping in a solution of chloride of antimony. Chocolate is obtained by burning on the surface of the brass moist red oxide of iron, and polished with a very small quantity of black lead.

Olive-green results from making the surface black by means of a solution of iron and arsenic in muriatic acid, polishing with a black lead brush, and coating it, when warm, with a lacquer composed of one part lac varnish, four of turmeric, and one of gamboge.

A steel-gray color is deposited on brass from a dilute boiling solution of chloride of arsenic; and a blue by careful treatment with strong hydrosulphite of soda.

Black is much used for optical brass work, and is obtained by coating the brass with a solution of platinum, or with chloride of gold mixed with nitrate of tin. The Japanese bronze their brass by boiling it in a solution of sulphate of copper, alum and verdigris.

Success in the art of bronzing greatly depends on circumstances, such as the temperature of the alloy or of the solution, the proportions of the metals used in forming the alloy, and the quality of the materials. The moment at which to withdraw the goods, the drying of them, and a hundred little items of care and manipulation, require attention which experience alone can impart.

To avoid giving any artificial color to brass, and yet to preserve it from becoming tarnished, it is usual to cover properly cleaned brass with a varnish called "lacquer." To prepare the brass for this, the goods, after being annealed, pickled, scoured and washed, as already explained, are either dipped for an instant in pure commercial nitrous acid, washed in clean water, and dried in sawdust, or immersed in a mixture of one part of nitric acid with four of water, till a white curd covers the surface, at which moment the goods are withdrawn, washed in clean water, and dried in sawdust. In the first case the brass will be bright; in the latter, a dead flat which is usually relieved by burnishing the prominent parts. Then the goods are dipped for an instant in commercial nitric acid, and well washed in water containing some ,argol (to preserve the color till lacquered), and dried in warm sawdust. So prepared, the goods are conveyed to the lacquer room, where they are heated on a hot plate and varnished.

The varnish used is one of spirit, consisting, in its simple form, of one ounce of shellac dissolved in one pint of alcohol. To this simple varnish are added such coloring substances as red sanders, dragon's-blood, and annatto, for imparting richness of color. To lower the tone of color. turmeric, gamboge, saffron, Cape aloes, and sandarac are used. The first group reddens, the second yellows the varnish, while a mixture of the two gives a pleasing orange.

A good pale lacquer consists of three parts of Cape aloes and one of turmeric to one of simple lac varnish. A full yellow contains four of turmeric and one of annatto to one of lac varnish. A gold lacquer, four of dragon's-blood and one of turmeric to one of lac varnish. A red, thirty-two parts of annatto and eight of dragon's-blood to one of lac varnish.

Lacquers suffer a chemical change by heat and light, and must therefore, be kept in a cool place and in dark vessels. The pans in use are either of glass or earthenware, and the brushes of camel's-hair with no metal fittings,—*Ironmonger's Review.*

The Heavens for July.

BY BERLIN H. WRIGHT.

MERCURY will be brightest July 24-27, being an evening star and setting as follows:

July 20—8h. 40m. evening.
" 25—8h. 31m. "
" 30—8h. 17m. "

This will not be a favorable opportunity to observe this planet, owing to its slight altitude at sunset, and the long duration of twilight.

VENUS will be very close to Uranus July 8, in the evening, being about one-fourth of a degree south of him. She will be at greatest eastern elongation July 16, being at that time 45° 33′ east of the sun, and having a half-moon phase. She will be 4° north of the moon July 22, at the time of setting. Venus is moving eastward past the stars, passing from the eastern part of Cancer to the eastern part of Leo in July. On the 5th of July she will cross the handle of the Sickle in Leo, being but one-half degree north of *A* Leonis (Regulus). Venus sets as follows:

July 5—9h. 57m. evening.
" 15—9h. 38m. "
" 25—9h. 16m. "

MARS will be 8° south of the Moon July 11,

and 90° west of the sun July 22, at which time he becomes an evening star. Mars is also advancing among the stars, moving from the middle of the constellation Pisces to 5° in Aries in July, keeping a little south of the Earth's path. There are no bright stars in his vicinity. Mars rises as follows:

July 10—11h. 48m. evening.
" 20—11h. 25m. "
" 30—11h. 0m. "

JUPITER will be in a very favorable position for observation and very brilliant throughout the month, rising as follows:

July 10—10h. 12m. evening.
" 20—9h. 30m. "
" 30—8h. 48m. "

He will be nearly 6° south of the moon July 8, and stationary July 2. He is retrograding or moving westward past the stars of the constellation Aquarius, being, in the latter part of the month about 8° south of the λ which marks the northern limit of the constellation.

JUPITER'S SATELLITES FOR JULY.

With an inverting telescope the Satellites will transit Jupiter from *right* to *left*, while the eclipses must *begin* at the *left* of the shadow and *end* at the *right* of it; also occultations begin at the left and end at the right limb of Jupiter's disc. The eclipses must all occur to the left of Jupiter for some time to come. For direct vision reverse the above directions.

SATELLITE I.	D.	H.	M.
Transit begins	4	3	38 morning
Occultation ends	5	3	6 "
Transit (shad.,) ends	3	11	13 evening
Transit ends	6	0	23 morning
Transit begins	11	4	19 "
Eclipse begins	12	2	32 "
Transit (shad.,) begins	12	10	47 evening
Transit, begins	12	11	53 "
Transit (shad.,) ends	13	1	7 morning
Transit ends	13	2	11 "
Occultation ends	13	11	22 evening
Eclipse begins	19	3	26 morning
Transit (shad.,) begins	20	0	41 "
Transit begins	20	1	40 "
Transit (shad.,) ends	20	3	1 "
Transit ends	20	3	58 "
Transit ends	21	10	25 evening
Transit (shad.,) begins	27	2	35 morning
Transit begins	27	3	26 "
Occultation ends	28	2	55 "
Transit begins	28	9	52 evening
Transit (shad.,) ends	28	11	23 "
Transit ends	29	0	10 morning
SATELLITE II.			
Eclipse begins	2	3	0 morning
Transit begins	3	11	43 evening
Transit (shad.,) ends	4	0	12 morning
Transit ends	4	2	34 morning
Transit (shad.,) begins	10	11	55 evening
Transit begins	11	2	9 morning
Transit (shad.) ends	11	2	49 "
Occultation ends	20	2	11 "
Eclipse begins	27	0	1 "
Transit ends	28	10	56 evening
SATELLITE III.			
Occultation ends	2	1	11 morning
Eclipse ends	9	0	12 "
Occultation begins	9	1	21 "
Eclipse begins	16	0	44 "
Eclipse ends	16	4	12 "
Transit ends	19	10	20 evening
Transit begins	26	10	20 "
Transit (shad.)	26	10	27 "
Transit ends	27	1	48 morning
SATELLITE IV.			
Transit (shad.,) ends	9	0	9 "
Eclipse begins	17	3	7 "
Transit ends	26	2	4 "

At the time of the beginning of the eclipse of Satellite IV (July 17, 3h. 7m. morning), the Satellites will occupy the following positions with respect to Jupiter: Satellites I and IV will be nearly equally distant at the right, and II and III on the left; II being half as far again east as I is west, while III is double the distance; direct vision being understood.

For the time of any of the above phenomena at any other place than New York City, *add* the difference of *time* if *east*, and *subtract* the same if *west* of New York.

SATURN will be 90° west of the sun July 7, being an evening star after that date. He will be 8° south of the moon July 11, and stationary July 28. He is moving eastward among the stars, and will be only about 1° southwest of Mars July 1. He rises as follows:

July 10—11h. 32m. evening.
" 20—10h. 53m. "
" 30—10h. 14m. "

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS FOR JULY 20, 1879.

	H.	M.
Alpha Andromedae (Alpheratz) rises	8	17 even
Beta Persei (Algol) rises	9	57 "
Eta Tauri (Alcyone or the "Light of the Pleiades") rises	0	21 morn
Alpha Tauri (Aldebaran) rises	1	40 "
Alpha Auriga (Capella) rises	11	4 even
Beta Orionis (Rigel) rises	3	47 morn
Alpha Orionis (Betelguese) rises	3	32 "
Alpha Canis Majoris (Sirius)	invisible.	
Alpha Canis Minoris (Procyon)	invisible.	
Alpha Leonis (Regulus) sets	8	52 even
Alpha Virginis (Spica) sets	10	48 "
Alpha Bootis (Arcturus) sets	1	32 morn
Alpha Scorpionis (Antares) sets	0	52 "

	H. M.
Alpha Lyrae (Vega) in merid	10 39 even
Alpha Aquillæ (Altair) in merid	11 51 "
Alpha Cygni (Deneb) in merid	0 47 morn
Alpha Pisces Australis (Formalhaut) rises	10 57 even

EPHEMERIDES OF THE VARIABLE STARS, FOR JULY, 1879.

[NOTE.—That event which is *visible* is always given.]

Beta PERSEI (Algol).—*Minima:*

July 7—5h. 7m. morning.
" 10—1h. 55m. "
" 12—10. 44m. evening.
" 30—3h. 35m. morning.

Delta LIBRÆ.—*Minima:*

July 2—11h. 8m. evening.
" 9—11h. 43m. "
" 16—11h. 18m. "
" 23—10h. 53m. "
" 30—10h. 28m. "

All of these occur just prior to the *setting* of the star.

U CORONÆ.—*Minima:*

July 24—2h. 8m. morning.
" 30—11h. 52m. evening.

This star sets on the 24th, about 3h. 6m. morning.

spicuous, though large constellation. Above him, with head southward, stands Hercules, a large and rich constellation, having its northern part distinguished by a large trapezium of stars. The Nebulæ 13 Messier, which we alluded to last month, is near the northwest corner of this trapezium.

West of the Meridian.—The Zodiacal constellation, Libra and its Trapezium, and 35° north of it that beautiful cluster, the Northern Crown, easily distinguished by the crescent formed by six stars resembling a part of an inverted crown. Further west and in the Zodiac is Virgo, the "Nebulous Constellation," in which Sir William Herschel discovered 323 nebulæ. The brilliant star Spica is on the right hand, and (if the observation be made about an hour earlier, while Regulus is on the western horizon) will be found about midway between Regulus and Antares. Arcturus, in Bootes, is northward from Spica, and a line joining them makes two right angles, with Regulus on the west and Antares on the east. Berenice's Hair is a beautiful cluster nearly north of Spica.

East of the Meridian.—About 20° above the southern horizon is the northern part of Sagittarius, the Archer, containing the inverted "Milk Dipper," with its handle pointing west-

LONG PERIOD VARIABLES.

Date.	*Star's Name.*	*R. A.*	*Declination.*	*Period in Days.*	*Change of Magnitude.*	*Phase.*
July 1.	*T* Herculis.	18h. 4m.	31° 0′ +	160	7.9 to 13	maximum
" 2.	*R* Sagittæ.	20h. 9m.	37° 39′ +	18 yrs.	8 to 6	minimum
" 10.	*R* Bootis.	14h. 31m.	27° 18′ +	196	8 to 12	minimum
" 11.	*S* Scorpii.	16h. 10m.	22° 35′ —	364	9 to 13	maximum
" 11.	*R* Ceti.	2h. 20m.	1° 0′ —	168	———	maximum
" 12.	*R* Herculis.	16h. 0m.	18° 43′ +	310	8.5 to 13.5	maximum
" 15.	*S* Geminorum.	7h. 35m.	23° 46′ +	294.07	9.2 to 13.5	maximum
" 16.	*S* Vulpeculae.	19h. 43m.	27° 0′ +	——	(?) to 10.5	minimum
" 17.	*T* Hydrae.	8h. 49m.	8° 39′ —	292 or 226	6.5 to 10.5	maximum
" 22.	*U* Virginis.	12h. 45m.	6° 16′ +	212	7.5 to 12	maximum
" 24.	*S* Librae.	14h. 45m.	11° 48′ —	——	8 to 9.5	maximum
" 30.	*V* Cancri.	8h. 14m.	17° 41′ +	——	———	maximum

SITUATION OF THE PRINCIPAL CONSTELLATIONS, CLUSTERS AND STARS JULY 15, 1879, 9H. 0M. EVENING.

[NOTE.—The observer is supposed to be looking southward, and in Lat. 40° north.]

Near the Meridian.—Low in the south is the Milky Way, branching about 10° above the horizon and bending eastward. The Scorpion is the first constellation, curling his long articulated tail about in the Milky Way, almost touching the horizon. Antares, a brilliant fiery red star, may be seen 25° up. Next northward is Ophiacus, the Serpent Bearer, a very incon-

ward in the Milky Way. North of Sagittarius about 30° is Aquila, a small but interesting constellation, easily recognized by a line of three stars 3° apart, of which the central one is Altair, a splendid star of the $1\frac{1}{2}$° magnitude. The line of these stars continued 35° northwest reaches Vega, a star ranked, by most astronomers, as next to Sirius in brilliancy. This star will, owing to the precession of the eqinoxes, become the polar star, some 10,000 years hence, and will be within 5° of the equinoctal pole. It will be a fine sight to see, the stars which will then be northern circumpolar circling about such a

brilliant centre. A short distance west of the Harp is Cygnus, the Swan, containing a conspicuous figure resembling a cross with the bright star Deneb at its head. The tree of the cross lies in one of the richest portions of the *Via Lactea.* About 13° northeast of Aquila lies Delphinus, the Dolphin, easily distinguished by means of the four principal stars in the head, which are so disposed as to form a diamond, pointing N. E. and S. W. This cluster is commonly known as "Job's Coffin." Aries, in the Zodiac, is just rising.

METEORS.—July 3d-4th, 14th-17th, 25th-30th, are quite well-established shooting-star epochs. The last has its radiant near *Gamma* Cygni.

Penn Yan, N. Y.

Advice to Bathers.

With a view of diminishing the loss of life which annually occurs from drowning, the Royal Humane Society of England issues the following seasonable advice to bathers: "Avoid bathing within two hours after a meal, or when exhausted by fatigue or from any other cause, or when the body is cooling after perspiration, and avoid bathing altogether in the open air if, after being a short time in the water, there is a sense of chilliness, with numbness of the hands and feet, but bathe when the body is warm, provided no time is lost in getting into the water. Avoid chilling the body by sitting or standing undressed on the banks or in boats, after having been in the water, or remaining too long in the water, but leave the water immediately there is the slightest feeling of chilliness. The vigorous and strong may bathe early in the morning on an empty stomach, but the young and those who are weak had better bathe two or three hours after a meal; the best time for such is from two to three hours after breakfast. Those who are subject to attacks of giddiness or faintness, and who suffer from palpitation and other sense of discomfort at the heart, should not bathe without first consulting their medical adviser."

Accidents.

In the *Scientific American* of recent date, Prof. Wilder, of Cornell University, gives a series of rules for action in case of accident. Some of these rules are decidedly injudicious. Thus it is recommended to "remove cinders, etc., from the eye with the round point of a lead pencil." Unless in very careful and steady hands, hard substances should never be applied to the eye. A fine camel hair brush which has been moistened, the moisture squeezed out, and the brush drawn to a fine point, is the best thing. It absorbs the moisture at the point where the cinder lies, and the latter adheres to the brush and is easily removed. Where a fine brush cannot be had, a narrow strip of bibulous paper, such as printing paper, rolled spirally so that it may have a fine point, is the best thing. It will remove specks more certainly than any hard substance, and there is no danger of hurting the eye by an unsteady movement.

He also directs us to use "acids" as antidotes to acid poisons, but this must be a misprint.

Where it is necessary to pass through rooms filled with smoke, he directs us to "take a full breath and then stoop low, but if carbon (carbonic acid?) is suspected, walk erect.

It is well known that the air of a smoky room, if filtered through a wet cloth, is greatly purified. Therefore, the best plan is to throw a wet handkerchief over the face. Carbonic acid is always present where there is fire, but when heated it rises, so that the direction to walk erect is decidedly injudicious. In almost all cases the air near the floor is pure, because, a current of cool air from without sets in towards the fire, and of necessity passes along the floor.

Skeleton Leaves.

The following is a simple method of preparing skeleton leaves, and is decidedly preferable to the old and tedious method of maceration, as it is quite as efficient and not at all offensive. First dissolve four ounces of common washing soda in a quart of boiling water, then add two ounces of slaked quicklime, and boil for about fifteen minutes. Allow the solution to cool; afterwards pour off all the clear liquor into a clean saucepan. When this liquor is at its boiling heat place the leaves carefully in the pan, and boil the whole together for an hour, adding from time to time enough water to make up for the loss by evaporation. The epidermis and parenchyma of some leaves will more readily separate than others. A good test is to try the leaves after they have been gently boiling for an hour, and if the cellular matter does not easily rub off betwixt the finger and thumb beneath cold water, boil them again for a short time. When the fleshy matter is found to be sufficiently softened, rub them separately but very gently beneath cold water until the perfect skeleton is exposed.

The skeletons, at first, are of a dirty white color; to make them of a pure white, and therefore more beautiful, all that is necessary is to bleach them in a weak solution of chloride of lime—a large teaspoonful of chloride of lime to a quart of water; if a few drops of vinegar are added to the solution it is all the better, for then the free chlorine is liberated. Do not allow them to remain too long in the bleaching liquor, or

they will become too brittle, and cannot afterwards be handled without injury. About fifteen minutes will be sufficient to make them white and clean looking. Dry the specimens in white blotting paper, beneath a gentle pressure. Simple leaves are the best for young beginners to experiment on; the vine, poplar, beach and ivy leaves make excellent skeletons. Care must be exercised in the selection of leaves, as well as the period of the year and the state of the atmosphere when the specimens are collected; otherwise, failure will be the result. The best months to gather the specimens are July and August. Never collect specimens in damp weather, and none but perfectly matured leaves ought to be selected.

Inks for Rubber Stamps and Stencils.

Black.—Rub together one part of finest lampblack and 2 parts of Prussian blue with a little glycerin, then add 1 part of powdered gum arabic, and enough glycerin to form a thin paste.

Carmine.—Dissolve 24 grains of carmine in 3 fl. oz. of water of ammonia, then add 2 fl. drachms of glycerin. Incorporate with this ½ oz. of powdered gum arabic.

Blue.—Rub together 6 parts of pure Prussian blue and 1 part oxalic acid with a little water, to a perfectly smooth paste. Let it stand in a rather warm place over night, then rub it with more water, and with 1 part of gum arabic to a thin paste.

Aniline Inks may be made of any desired shade in the same manner. The best way of using these inks is by applying them, by means of a small pad, uniformly to a little cushion, on which the stamps are then inked.

The above formulæ have been furnished to us by a correspondent, who says he has tested them by experience, Another set of formulæ, also highly recommended, is the following:

Black.—Finest lampblack, 10 parts; powdered gum arabic, 4 parts; glycerin, 4 parts, water, 3 parts. Dissolve the gum arabic in the water, add the glycerin, then rub the lampblack with the mixture in a mortar.

Colored.—Replace the lampblack in the above formula by the appropriate color: chrome-yellow for *yellow;* red lead or red ochre for *red;* green, ultramarine, or chrome-green for *green;* indigo or Prussian blue, or blue ultramarine for *blue;* umber for *brown*, etc.

Removing Metal Splinters from the Eye.

The ragged chips and splinters which are separated during the processes of turning and chipping off, often find their way into the eye, and are sometimes very difficult to remove. The use of magnets has been recommended, but even the strongest magnet is entirely inefficient, if the splinters be imbedded. We have found a fine, sharp knife the best instrument, but it requires skill and a steady hand. The best method is that which a London surgeon thus describes in the *Lancet*: "In consequence of the difficulty I experienced in removing from a patient a portion of steel deeply bedded in the cornea, which did not yield to spud or needle, some other means of removal became necessary. Dry, soft, white silk waste suggested itself to me, and was wound around a thin piece of wood, so as to completely envelop its end. This soft application was brushed once backwards and forwards horizontally over the part of the cornea where the foreign substance seemed fixed. To my astonishment it was at once entangled by the delicate but strong meshes of the silk, and was withdrawn with the greatest ease, caught by the same. A gentleman in turning steel at a lathe suddenly felt that a portion had entered his eye. He went at once to a surgeon, who with the most skilful manipulation failed to extract the same, saying it would soon work out of itself. The next morning the patient saw me, having suffered severely since the accident, and on the first application of the silk, the portion of steel was extracted."

The Family Hammer.

There is one thing no family pretends to do without. That is a hammer. And yet there is nothing that goes to make up the equipment of a domestic establishment that causes one-half as much agony and profanity as a hammer. It is always an old hammer, with a handle that is inclined to sliver, and always bound to slip. The face is as round as a full moon and as smooth as glass. When it strikes a nail full and square, which it has been known to do, the act will be found to result from a combination of pure accidents.

The family hammer is one of those rare articles we never profit by. When it glides off a nail head, and mashes down a couple of fingers, we unhesitatingly deposit it in the yard, and observe that we will never use it again. But the blood has hardly dried on the rag before we are out doors in search of that hammer, and ready to make another trial. The result rarely varies, but we never profit by it. The awful weapon goes on knocking off our nails, and mashing whole joints, and slipping off the handle to the confusion of mantel ornaments, and breaking the commandments, and cutting up an assortment of astounding and unfortunate

antics without let or hindrance. And yet we put up with it, and put the handle on again, and lay it where it won't get lost, and do up our mutilated and smarting fingers, and yet if the outrageous thing should happen to get lost, we kick up a regular hullabooloo until it is found again. Talk about the tyrannizing influence of a bad habit! It is not to be compared to the family hammer.

Practical Hints.

Bleaching Piano Keys.—A writer in the *English Mechanic* says that the reason why piano keys turn yellow is because they absorb the grease from the fingers; it is therefore necessary to neutralize this. If a paste made from whiting and a solution of potash is laid on and allowed to remain for twenty-four hours, the ivories will be restored very nearly, if not quite, to their original color without removing them from the keys.

Bronzing Liquid.—Dissolve 10 parts of fuchsine and 5 parts of aniline-purple in 100 parts of 95 per cent alcohol on a water bath; after solution has taken place, add 5 parts of benzoic acid, and keep the whole boiling for 5 or 10 minutes, until the green color of the mixture has given place to a fine light bronze-brown. This liquid may be applied to all metals, as well as many other substances, yields a very brilliant coating, and dries quickly. It is applied with a brush,

Imitation Inlaying.—Suppose I want an oak panel with a design inlaid with walnut. I grain the panel wholly in oil. This is not a bad ground for walnut. When the oak is dry, I grain the whole of the panel in distemper. I have a paper with the design drawn thereon, the back of which I rub with whiting, place it on the panel, and with a pointed stick trace the design. I then with a brush and quick varnish trace the whole of the design. When the varnish is dry, with a sponge and water I remove the distemper, where the varnish has not touched. This, if well executed, presents a most beautiful imitation of inlaid wood. Marbles are executed in a similar manner.

Deceptive Vision.—There is a tendency in the eye to enlarge the upper portion of any object on which it looks—a fact which we find admirably illustrated by a row of ordinary capital letters and figures:

SSSSSSSSSSSXXXXXX3333333388888888888888

They are such as are made up of two parts of equal shapes. Look carefully at these, and you will perceive that the upper halves of the characters are a little smaller than the lower halves—so little that an ordinary eye will perhaps declare them to be of equal size. Now turn the page upside down, and, without any careful looking, you will see that this difference in size is very much exaggerated; that the real top part of the letter is very much smaller than the bottom.

Oleographs.—The beautiful cohesion figures formed by oil when dropped on water, are easily rendered permanent, and form very pretty ornaments, or if made in large numbers and kept in a portfolio, they are exceedingly interesting from their beauty and variety. Any one may produce them, figures and impressions, too, by the following simple means. Take a soup plate of water, let it stand till all the ripples have subsided, and then let fall in the centre one small drop of any oil that is at hand—salad oil, sperm oil, lard oil, or any other. The height of the fall should be about four inches. In an instant the drop spreads into a filmy disk, some four or five inches in diameter, and during the following two or three minutes a strange commotion is set up, the film breaking into circular holes sometimes of uniform size, at others in varying dimensions, according to the nature of the oil, and these are continually changing their configuration. At some points the whole will appear as a graceful pattern—it may be like a piece of ladies' crochet, or tatting work, or a simple reticulation, or a net work of beaded threads. To fix the pattern—to make the oleograph—it is only necessary to lay a sheet of glazed paper carefully upon the water's surface for an instant, and then float it upon a plate of common ink, or colored fluid of any kind. The paper will take ink where there is no oil, and leave the greasy markings intact. There you have your picture.

How to Keep Canary Birds.—Many persons have difficulty in keeping their canary birds in good health. One who is experienced in their care says: Place the cage so that no strong draft of air can strike the bird, and avoid also all exposure to the direct rays of the sun. Remember also that thin white cloth gives but little protection in summer from the sun's light and heat. Give nothing to the healthy birds but canary and rape seed, mixed with water, cuttlefish bone, and gravel on the floor of the cage; also, occasionally, a little water for bathing; the room should not be overheated; when moulting (shedding feathers) avoid drafts of air, give plenty of rape seed slightly moistened; a little hard-boiled egg and cracker grated fine is excellent, By observing these simple directions, birds may be kept in fine condition for years. Bad seeds kill most birds that die; to which it might be added, that canary birds are not only fond of but benefited by having often a leaf of cabbage, piece of apple, or other green food, which serves to keep down the tendency to fever and prevents constipation. Our birds usually bathe each day as regularly as any one who washes the face, and with apparent benefit, too. When birds are sick, and inclined not to eat well, remove all the food for a day, and then only give soaked bread, from which most of the moisture had been squeezed.

EXCHANGES.

A Smith & Wesson automatic ejector revolver, key check and stencil plate outfits, wanted for a combination saw, lathe, &c. Thos. D. Adams, Lock Box 61, Franklin, Pa.

J. T. Bell, Franklin, Pa., has brass condensing and exhausting air syringe, 100 good specimens (75 lbs) mostly silver ore, to exchange for gun, telescope, magic lantern, music box, or offers.

Wanted, back No.'s of the YOUNG SCIENTIST (for 1878), for a good dark lantern, cost $1.25. G. U. Bigelow, Palmyra, N. Y.

Duplicate collections of sea mosses from Oregon coast, for eye-glasses, back No.'s YOUNG SCIENTIST, or paper (working) pattern of best puzzle. Theo. Boone, Oneatta, Benton Co., Oregon.

Wanted, a microscope with accessories, in good condition, worth $5 or $10; state what is wanted in exchange. Will. H. Brewster, Middlebury, Vt.

Three vols. of Frank Leslie's Boys and Girls Weekly, cost $2.50 vol., to exchange 6 months for vol. 1 of YOUNG SCIENTIST, the rest for good books on electricity and science. Walter M. Brown, Owen Sound, Ont.. Canada.

Wanted, book, "Corner Cupboard or Facts for Everybody," in exchange for a card printer and type. H. E. Burnham, 176 Adams Ave. E., Detroit, Mich.

State what will be given for 250 foreign stamps, all different; list of other stamps sent on application. C. E. Chegwidden, 140th street, Mott Haven, N. Y.

Wanted, in exchange for good guitar, cost $25, a stationary engine, or bracket saw and turning lathe combined, or offers. Frankie Park, Dodge's Corners, Waukesha Co., Wis.

I have a magic lantern with 35 slides, cost $5; would like to exchange it for almost anything of similar value. Address all offers to C. Von Eiff, Box 4,465, City.

Fine carbine rifle, loads from muzzle or breech, in good condition; will exchange it for a double barrel shot gun, watch, or small rifle with bore 22-100. The Editor's Eye, 209 Rhodes Ave., Chicago, Ill.

Wanted, to exchange, North Carolina minerals, shells, stamps and Confederate money, for minerals, archæological specimens, Indian relics, vertebrate and invertebrate fossils, and curiosities for my museum. Robert H. Engle, Box 325, Raleigh, N. C.

Three volumes of Oliver Optic's (Wm. T. Adam's) works, Seek and Find, Fighting Joe, and The Yankee Middy, exchanged for cabinet mineral specimens. Anthony Garner, P. O. 53, Ashland, Pa.

To exchange, a seven shooting revolver of best make, in good condition, size of bore 22-100 in.; state what is offered in exchange. H. V. H., P. O. Box 47, Coeymans, Albany Co., N. Y.

Fairbank's No. 1 chemical scales and weights, cost $15, for a bracket saw with or without lathe attachment; scales warranted perfect; will give a *good* trade. Samuel J. Jones, Box 137, Oxford, N. C.

Wanted, double-barrel shot-gun or scroll saw, in exchange for telegraphic key and sounder on one base, Craig microscope, etc. C. H. Jordan, Shimersville, Lehigh Co., Pa.

Unmounted microscopic objects such as foraminifera, spicules, starches and parts of foreign insects, &c., to exchange for other mounted or unmounted objects. S. N. Hardy, Victoria, Cass Co., Neb.

A complete outfit for making chromo photographs and a small magic lantern and slides, worth $10, for a 5x7 printing press, or type, or a combination scroll saw and lathe. Geo. L. Lamson, La Fargeville, N. Y.

An oscillating steam engine, 1-inch bore, 2-inch stroke, to exchange for a household microscope, or offers. L. E. Kent, Santa Ana, Los Angelos Co., Cal.

Lippincott's, $4.00; Popular Science, $5.00; Phrenological, $2.00; Sanitarian, $3.00; Library, 3 copies $1.00 each; Housekeeper, $1.00; all monthlies, 1879, complete; Daily Sun, N. Y.; Star, Cincinnati, 1 year, $5.00; make offers. C. H. Kimball, Plymouth, N. H.

Wanted, correspondents to exchange insects with; will send full instructions for capture and make liberal exchanges. C. W. L., Box 3,565, N. Y. City.

Choice cabinet mineral specimens, for historical, scientific, masonic or other instructive books. C. A. Leeper, Bonanza City, Lemhi Co., Idaho.

To exchange, certificate for a course of lessons in shorthand writing, for books, or offers; also copies of the Student's Journal, for copies of YOUNG SCIENTIST; state what numbers you can furnish. H. C. Lucas, Macomb, Ill.

Wanted, all numbers of the YOUNG SCIENTIST for 1878, in exchange for the Story of a Bad Boy, or Chance for Himself; each cost $1.25. Jesse H. McIntire, Rockport, Mass.

Wanted, Queen's or McAllister's Household microscope; specimens of insects, woods, &c., in exchange; or state what is wanted. W. C. McNaul, Salina, Clinton Co., Pa.

Minerals, fossils, Indian relics and foreign stamps wanted, in exchange for same, or for greenhouse plants. Send list to Wm. J. Morgan, Somerville, N. J.

Wanted, a good wood lathe with attachments; state what is wanted in exchange, giving description of lathe. C. W. Munson, Nashville, Tenn.

Wanted, printing press, for a scroll saw and tools for finishing work. T. H. Nicholson, 14 East 127th St., N. Y. City.

To exchange, a novelty printing press, type and accessories, for a microscope with accessories, or minerals, or offers. T. W. Patterson, Warsaw, N. Y.

Wanted, a small printing press, Model or Novelty preferred, in exchange for a French microscope, objects and accessories, worth $20. C. L. Peticolas, 635 8th St. North, Richmond, Va.

Wanted, stereo camera with lens, ½ size view camera and lens, photo chemicals or offers, for rosewood writing desk inlaid with mother of pearl, and complete rosewood box of drawing instruments. A. B. Porter, 501 North Tenn. St., Indianapolis.

Wanted, a turning lathe from ½ to 2 inches swing; state what is wanted in return. Grant Price, Lock Box E, Cherokee, Crawford Co., Kan.

Wanted, a good set of engravers tools and a book of instruction, in exchange for an aquarium. H. E. Rhodes, Brighton, Iowa.

Wanted, to exchange, books for type; send specimen of printing of type; also state weight of font &c. J. Siler, 1,242 Broadway, St. Louis, Mo.

To exchange, a new book on fret sawing and wood carving, well illustrated and very handsomely bound, for good mineral specimens; also coins to exchange for minerals, &c. A. H. Spencer, East Clarendon, Vt.

Wanted, a good microscope or a pair of telephones, or other apparatus, in exchange for a photographic camera, lens, plate-holder, tripod, &c., valued at $5, entirely new, and enclosed in a neat case. Sheldon Sperry, 99 Lee Ave., Brooklyn, E. D., N. Y.

A collection of foreign and U. S. stamps, some paints and colored pencils, in exchange for Indian relics. Sherman Sweeting, South Butler, Wayne Co., N. Y.

A strong magnet, in exchange for Indian relics. Sherman Sweeting, South Butler, Wayne Co., N. Y.

The Young Scientist

SCIENCE IS KNOWLEDGE. KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

VOL. II. NEW YORK, SEPTEMBER, 1879. No. 9.

Hardening and Tempering Steel Tools.

THE following thoroughly practical article on hardening and tempering steel tools, was contributed by Mr. Jas. Nasmyth to Northcott's work on "Lathes." As it is especially suited for amateurs, we reproduce it:

Whatever be the efficiency of the construction of a lathe, or other machine for cutting metal and other materials, the excellence of the result must ultimately depend not only on the proper form of the tool which operates on the work, but also on its capability to retain its cutting edge. This depends on the tool possessing the proper degree of hardness and temper.

Before proceeding to the immediate subject of these remarks, it may be as well to say a few words on the subject of the treatment of steel in forging it into the form of the tool required. In this respect, whatever be the form of the tool, it is most important for the preservation of the original good quality of the steel that, in forging it into the required form, the lowest degree of red heat should be given to the steel as may be consistent with its capability to receive the desired form by the action of the hammer. Any degree of heat beyond that which is just visibly red in daylight, risks a permanent injury to the quality of the steel.

In forging all such tools as are of a flat form, it is highly desirable that the finishing blows should be given on the flat, and not on the edge or sideways of the tool. Attention to this apparently trifling observation will be well rewarded by the enhanced durability of the tool so produced.

In respect to "hardening" and "tempering" of steel tools, they are two distinct processes; hardening first, tempering afterwards. The first induces the maximum of hardness, accompanied by brittleness; the second has reference to modifying that hardness, and so gaining in exchange a certain degree of toughness.

For the majority of tools employed in

self-acting lathes and planing machines, in which cast iron, steel, and brass, is turned, or planed, steel tools when properly *hardened* are best fitted to withstand the duty required of them, no *tempering* or modification of their original hardness being requisite or desirable.

In order to "harden" such tools, all that is requisite is to heat the operative part to *just* such a degree of red heat as that when plunged into cold water they shall just become hard—any degree of heat beyond this will prove seriously injurious to the capability of the cutting edge in preserving its keenness and power of resisting the strain of the cut. Such a degree of red heat as will be barely visible in daylight, is ample to cause steel to acquire the maximum of hardness when plunged into cold water.

Want of due care and attention to these conditions in hardening steel is a more fertile source of failure and disappointment than many are aware of. If those who have to do with practical management of machines requiring the use of steel tools would carefully attend to the above observations, the results would well repay them for the special attentions given to the subject.

In the case of such tools as are employed in the generality of wood-turning, and for screw-taps, drills, chipping chisels, and the like, the process of "tempering" is requisite.

Tempering in this case, as the word signifies, is the modification to a greater or less degree of the original hardness and brittleness, due to and natural to the process of hardening. Tempering, in fact, is the process whereby we exchange some of the original hardness in order to gain a corresponding equivalent of toughness, and is attainted by re-heating to certain degrees the original hardened tool.

The mode by which this tempering process is most conveniently attained is by grinding the part of the tool we desire to temper so as to render it bright, and then, by resting it on a piece of red-hot iron, we thereby communicate to our hardened tool such a degree of heat as shall modify or "let down" the hardness, and induce such a degree of toughness as will best suit the requirements of the case. The progress of re-heating effected in this manner is easily observed by the brightened surface of the tool acquiring in succession a series of prismatic colors. Thus:

1st. Pale straw color.
2d. Brass color.
3d. Deep brass color.
4th. Reddish purple.
5th. Purple.
6th. Blue.
7th. Slate blue.

Beyond slate blue all remaining hardness, such as is required for the generality of purposes, terminates, and the steel returns to softness.

According to the purpose to which the tool is to be applied, the degree of temper or modification of the original full, hard condition may be arrested by plunging it into cold water the instant the color indicating the desired "temper" has come on. 1, 2, 3, as from the above list, serve well for most wood-turning tools. 3 and 4 for screw taps and drills, and for chisels for chipping iron and brass. 5. 6, 7, for springs or such purposes where a certain degree of elasticity may be required in conjunction with a very moderate degree of hardness.

To say nothing as to the importance to practical mechanics of a thorough knowledge of the art of hardening and tempering steel, on which the final efficiency of all our lathes, planing and other metal working machines depends, we would earnestly recommend to the amateur workman to devote a few hours to acquire the art of hardening or tempering steel in accordance with the brief practical hints we have endeavored to give in the preceding remarks on the subject.

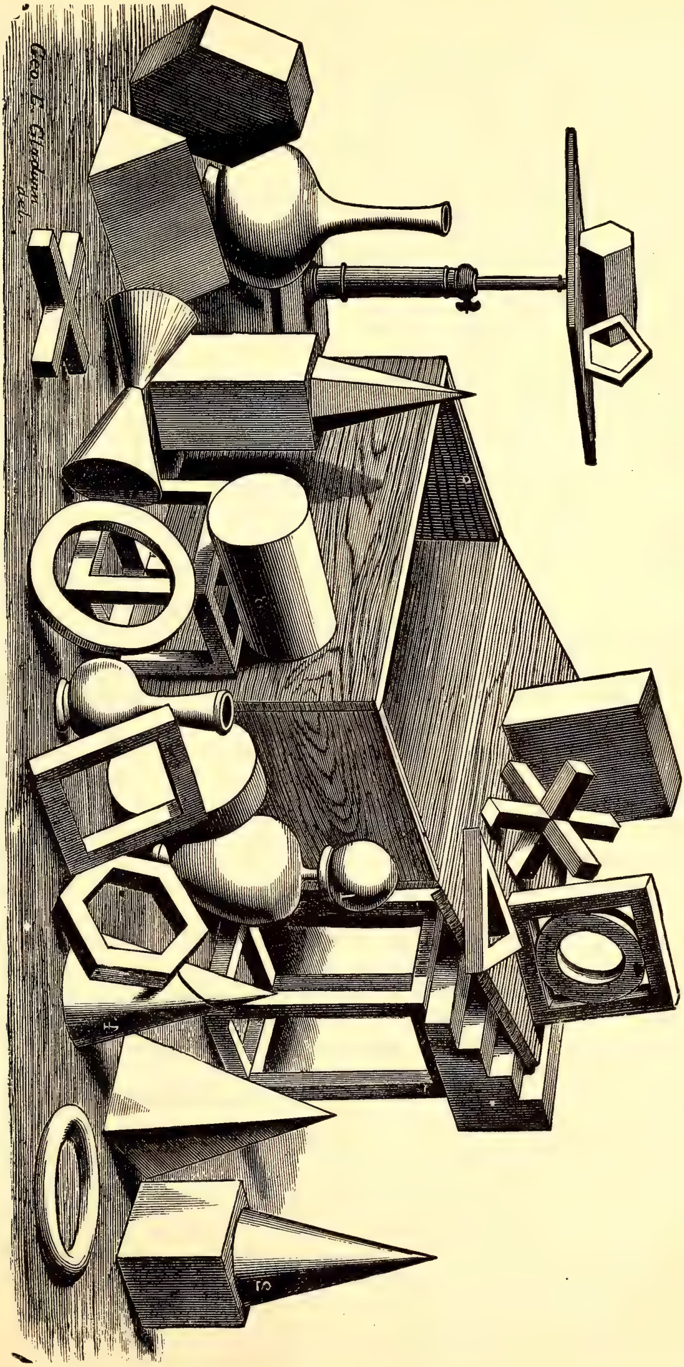
Drawing Lessons—III.

BY JOHN CLARK CENTER.

Drawing Models.

As it may be difficult for some of our readers to procure "The Geometrical Models," as subjects for study, we furnish by our full-page illustration a grouped collection of the most important ones used in art educational schools.

The five primary solids are the cube, the



THE GEOMETRICAL MODELS.

pyramid, the cone, the cylinder, and the sphere. To these all natural and artificial objects bear some resemblance. For instance we find the sphere in the orange, apple, etc. The cone we find in the carrot, the trunk of trees, etc., and so on indefinitely with the others. The importance of the study of geometrical figures and mathematical solids will be apparent to all, in the study of freehand and mechanical drawing.

Let the student select for practice, say the cone, the cube, the pyramid, and circular ring, at the right hand of the engraving; draw them at least four times the size, and attempt to shade them. In shading with the lead pencil use a rather flat point. The parts in shade cover with a uniform tint, adding depth and strength gradually, following the same direction of line as in copy. This will enable you to see the outline assume the solid form. The art of shading, however, will be treated fully upon at a more advanced stage.

We would, however, caution some at this point not to try too much at first, as the great object is to master an exact outline; many fail by trying to hide this defect by a spurious and indiscriminate blending of shades, which the uneducated eye thinks pretty. This is death to all progress. Let the student continue to select other groups, and treat them in like manner, by which means alone he can become familiar with the proper forms. In drawing the box with the lid open, you will have a practical test of the former lesson. In every case the nearest parallelogram must be first drawn, then the whole figure to which it belongs. Auxiliary test lines will suggest themselves to find the angles of the next object, and so on.

The cylinder will require some special attention in its treatment as a study, as the circle has to undergo an indefinite number of changes in relation to its position with the eye. It is often difficult with both young and old to understand the plane of a circle or orbit. Perhaps as ready a method as any, is to take a ring or hoop, which at once describes a circle, or orbit, and turning it in various directions in the hand show the alteration of the plane. It then assumes an oval form, more or less broad, according as it is more nearly level with the eye, or more below it.

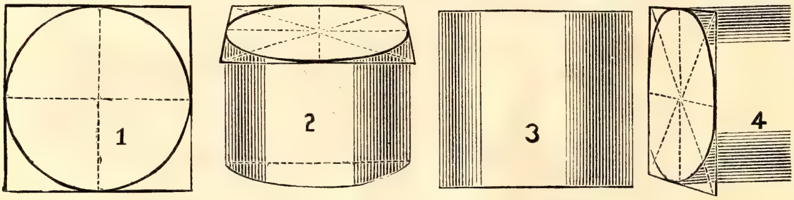
It appears as a straight line when exactly level with the eye. The following diagrams will convey this idea in a very simple manner.

If the ends of a cylinder be presented directly in front of the eye, we have the circle. If it stands on end, and is viewed obliquely, we have the oval; its method of construction is indicated in Fig. 2. Here we have the top of the cube in perspective; by drawing the diagonals we have at the point of intersection the centre, through which draw the bisecting lines. The oval can now be drawn in easy sections, observing that the half furthest from the eye is the smallest. This same law holds good on all sides of the cube, and the oval form that the circle assumes under all conditions, is to be determined by the parallelogram that a square describes seen in perspective.

Fig. 3 shows a straight line, as the eye is on an exact level with the object.

Fig. 4 shows the cylinder in a horizontal position viewed from the end.

All the other geometrical forms, the pentagon, hexagon, etc., etc., follow the same laws of construction when drawn in



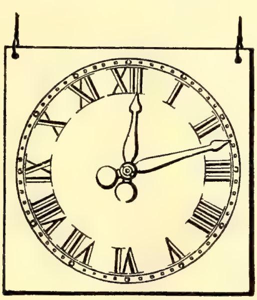
THE CIRCLE AS SEEN FROM DIFFERENT POINTS OF VIEW.

perspective, and will call for a good deal of ingenuity and skill to master them perfectly.

By a proper study of our model plate, (where the originals cannot be procured) the ability to draw objects from nature may be cultivated. The student will find more difficulty in this than in merely copying lines already laid down, unless he understands what we have taught in the former lessons, which are but as the alphabet to be used in connection with the laws of perspective, to determine nature, and present in your work a mirror of truth.

Mysterious Clocks.

THERE is at the present time quite a furor for mysterious or magic clocks which shall puzzle the observer to tell how they are driven. One of the simplest and best is that shown in the engraving. The clock apparently consists of a square plate of glass which is suspended by cords, so as to be entirely unconnected with any mechanical source of power. On this



MAGIC CLOCK.

plate are marked the figures for hours and minutes, and attached to the centre are two hands which move round the dial and point to the time with considerable accuracy. A very curious feature of this clock is the fact that the hands seem to turn loosely on the central point, and if twirled around any number of times, will settle back to the right place, even making allowance for the few seconds in which they have been moving. They may also be taken off and laid away for some hours, and when again placed in position, they will indicate the correct time.

The secret of this clock lies in the counterpoises attached to the hands. These counterpoises contain the works, and the positions of the hands are determined by weights which these works move out and in from the centre, thus giving the weights greater or less leverage, and causing the hands to act in the same way as the well-known bent lever balance.

The New Copying Process.

SOME time ago, a new method for rapidly producing copies of letters, or any kind of written matter, was made the basis of a patent in Austria. The simplicity and facility of working the apparatus immediately attracted universal attention, but the high price of the first apparatus was not at all in proportion to the cheap materials, even allowing for a very respectable profit. It was soon ascertained that the process, or rather the composition of the printing material, was not capable of being patented, being nothing else than gelatine (or glue) and glycerine. Since then, in Europe as well as in the United States, a number of such apparatus, have made their appearance under various names, such as Copygraph, Copygram, Hectograph, Lithogram, Cheirograph, Autograph, Multigraph, etc. Competition has so reduced the prices of these that they are now sold at not unreasonable rates, and many will prefer to buy them ready made with all the necessary appliances. But for those who wish to make an apparatus for themselves, we append several methods:

1. Take one part by weight of gelatine (glue does just as well), let it swell in two parts of water, melt, and add four parts of (common) glycerine, with a few drops of carbolic acid, and sufficient whiting or white lead to make the whole milky. Pour the mixture into a shallow tin or zinc dish; it will be ready for use in about twelve hours.

2. Ten parts of gelatine are softened in water, and then dissolved in 100 parts of concentrated glycerine, on the water-bath. When melted, the mass is slowly and carefully poured into a tin-tray, about $\frac{1}{2}$ cm. ($\frac{3}{8}$-$\frac{3}{4}$ inch) deep, and of any desired

size. Any rising air bubbles must be removed, and the mass is then allowed to become cold, when it will form an elastic mass, a little firmer than printer's rollers. Other formulæ substantially the same, but with slight changes in the proportions, and the addition of various unimportant ingredients, have been published. In any case the resulting mass has the property of absorbing to the depth of perhaps 1-64 inch writing or tracings made with certain kinds of ink, particularly aniline-inks. Any aqueous ink would answer, but it is necessary to use one which is made of a very persistent color. The writing desired to be multiplied is written upon a sheet of paper with the special ink described hereafter; after the ink is completely dry, the sheet is laid on the moistened gelatine-surface (writing down). and gently rubbed over with the hand. After a short time (about half a minute), the paper is removed and laid aside. Fresh paper being ready, a sheet is laid upon the writing, and the hand gently rubbed over the back, when a clear and complete copy of the writing will be found on the paper. This may be repeated from sixty to a hundred times, according to the quality of the ink, and the experience of the operator. When no more copies are wanted, or when the ink is exhausted, the surface is washed off with a sponge and cold water. Any traces of the ink left in the mass, after thoroughly washing, will not interfere with the next copy. When necessary, the mass in the tray may be remelted.

The ink may be prepared as follows:

Violet: methyl-violet, 2: dilute acetic acid, 2; water, 4 parts.

Or, *red:* fuchsine, 2; alcohol, 1; water, 8 parts.

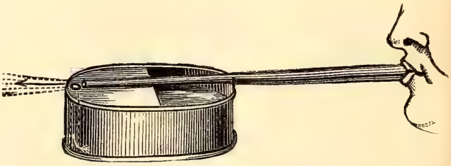
Or: Mix 5 parts of any desirable aniline color, 5 of alcohol, 5 of mucilage, and 35 of water in a flask, heat until dissolved, and after 24 hours strain through flannel or wool. The selection of aniline-colors is difficult, as many of them are largely composed of *dextrin*, which dries up or makes the solutions thick. The best aniline color, according to E. Störmer. is the Violet de Paris de Poirrier.

This apparatus is specially valuable to microscopists and naturalists, who require a few dozen copies of exchange lists or descriptions of apparatus. To have such lists printed is a process altogether too expensive, while few are able to afford electric pens and similar apparatus. The simple contrivance which we have described, and which may be made at an expense of a few dimes, answers every purpose.

A New Form of Sprinkler.

A SIMPLE method of distributing a liquid in fine spray, is one much needed in many operations. The old-fashioned sprinkler with its nozzle perforated with numerous holes, is probably the oldest device of the kind, but it is a very imperfect one. The method used by those who practice "spatter-work" gives finer spray, but lacks the ability to give sufficient quantity to moisten articles, such as paper, cloth, etc., thoroughly.

One of the most perfect contrivances of the kind that we have seen, consists of an application of the atomiser, and is in use amongst silk-manufacturers for moistening the silk during certain processes. It is very simple and easily made, as will be evident from the accompanying engraving. It consists of a tin vessel



ATOMIZER FOR SPRINKLING.

across the top of which is fixed a tube through which air may be blown. The tube is supported by the edge of the vessel and also by a tin plate which covers half the vessel next the mouth of the operator. The point of the tube ends about an inch from the opposite side of the vessel, and on a level with the edge. When the vessel is filled with water, and a blast of air is sent through the tube, the water is lifted up and scattered in the finest spray. As the liquid sinks in the vessel, the apparatus is tipped so as to bring the water up to the edge, and in this

way the last drop may be dispersed in spray.

The applications which might be made of this simple device are almost innumerable.

Puzzles as Mental Exercises.

THE following puzzles are good, considered merely as puzzles, but when analyzed, as we find them in the *Household*, so as to show the particular way in which the mind is led astray from the correct answers, they become most interesting and valuable studies:

"Two brothers," began the Professor, impressively addressing the hostess, "were walking together down the street, and one of them, stopping at a certain house, knocked at the door, observing, 'I have a niece here who is ill.' 'Thank heaven,' observed the other, 'I have got no niece,' and he walked away. Now how could that be?"

"Why, it's a riddle!" exclaimed Mr. Funnidog, delightedly.

"And one that you will not guess in a hurry, simple as it is," observed the Professor confidently. "Come, ladies and gentlemen, solve the problem."

"I see——," ejaculated Mrs. Housewife.

"Hush! whisper in my ear," cried Puzzleton, with all the excitement of a child with a top. "Don't let 'em hear it. 'Niece by marriage.' Stuff and nonsense, The thing is not any foolish kind of catch at all;" and once more he glanced with hostility at Funnidog, as much as to say, "Such as he would ask you." Nothing can be simpler than my question. "I've got a niece, that's ill," says one brother. "Thank heaven, I have not got a niece," says the other. "How can that be? You all give up? Well, the invalid was his daughter."

"Oh, I see," said Mrs. Housewife despondingly. "How very stupid in us not to find it out.

"Yes indeed, ma'am," answered the remorseless savant. "That failure only shows how difficult it is for ordinary minds to grasp more than one idea at the same time. The attention is solely fixed on the different varieties of nieces."

"And, also," observed Mr. Aloes (who was much displeased at being classed among "ordinary minds"), "and, also, the attention is naturally distracted from the point at issue by the brutality of the father's remark. Now that is in itself 'a catch,' in my opinion."

"Well, Sir, I will give you another simple exercise for the understanding that has no such distracting element," observed the Professor, cooly. "A blind beggar had a brother. The brother died. What relation were they to one another? Come, tell me that."

"Why, they were brothers," exclaimed the colonel, with the rapidity of a small boy at the bottom of his class, who hopes to gain promotion.

"No, sir," answered the Professor, regarding Thunderbomb with interest, as a significant type of some low order of intelligence, "they were not brothers, or I should scarcely have asked the question."

"They might be brothers-in-law," suggested Funnidog.

"Undoubtedly they might," replied Puzzleton, with a pitying smile; "but they were not."

"Stop a bit," said McPherson, hurriedly, like one who has not got his answer quite ready, but yet doesn't wish to be anticipated. "The blind beggar, you said, had a brother, and the brother died. Well, of course, if one was dead, you know they could not be brothers any longer."

"The idea is novel," observed the Professor, gravely, "but you have not hit upon the exact solution. The fact is, gentlemen and ladies, a blind beggar may be either male or female. In this instance she was a female. They were brother and sister."

"I call that a catch," said Aloes, gloomily.

"Well, at all events, it was an easy one, and you all missed it," returned the Professor, with quiet triumph. "Now, I will give you one more example of social arithmetic, which will be in all respects *bona fide*. It is a simple question in subtraction, and all I ask of you is—since two or three guesses would arrive at the truth by mere elimination—to write down the reply on paper. A man went into a

cobbler's and bought a pair of boots for sixteen shillings. He put down a sovereign (twenty shillings), and the cobbler having no change, sent to a neighboring public house, and gave it to him. Later in the day, the landlord of the inn sent in to say that the sovereign was a bad one, and insisted upon the cobbler making it right; which he accordingly did. Now, how much did the cobbler lose by the whole transaction? There is no play upon words, or anything but a common sum in arithmetic."

"Why, it's the easiest thing in the world," ejaculated Housewife. "Of course the cobbler lost just—"

"Be quiet, sir!" cried Puzzleton very angrily. "Write it down, will you, if you can write."

"Scratch a Professor, and you find a Tartar," whispered Aloes. "You had better do as he wishes."

So we all wrote down what we imagined to be the loss which the cobbler had sustained; and it was wonderful how opinions differed within such narrow limits.

The colonel made him lose two pounds.

Mr. Aloes made him lose just a pound and the boots.

Mr. Funnidog made him lose six and thirty shillings.

Mr. McPherson made him lose sixteen shillings and the boots, minus the profit he made upon the boots (which, the Professor said, was not necessary to take into consideration.)

Mr. Scale Hill, who used to investigate the bills of extortionate Swiss landlords, set down the loss with confidence at twelve shillings and the boots.

Housewife wrote:—"Why, of course, he lost the boots and twenty-four shillings."

Mrs. Housewife and the ladies bit their pens, but declined to commit themselves. "They had never been taught," they said, "the Rule of Three."

"You are all wrong," said the Professor, quietly, "as I expected you would be. The way to get at the matter is to consider what is gained. The landlord and his whole story of changing the sovereign may be taken out of the question, since he is neither better nor worse for the transaction. The buyer of the boots gets in exchange for his bad sovereign four shillings and a pair of boots, and that is just what the cobbler loses."

"If one only had a room to one's self, and the whole day before one to do it in," sighed Mrs. Housewife; "I think I could answer any of these questions."

Paper Flower-Making.

PAPER flower-making may in some sense be regarded as a fancy industry for ladies; inasmuch as small manuals of instruction in the art have been published for their use, and sets of necessary appliances prepared for sale. Nevertheless, this is but an offshoot from the larger trade occupation. The tools necessary are very simple. Pincers to hold the small piece of paper firmly, and to assist in preparing the petals; "ball-tools" of various diameters to work the petals into a hollow form; or crimping or gauffering tools, to give the marking to leaves, etc., are the principal. Of the materials, the chief, of course, are paper, used for the petals, leaves, and buds; it is sold in sheets of almost infinite varieties of color, or in pieces so far shaped, crimped, and gauffered, as to expedite the labors of the flower-maker. The few other materials for buds, stalks, etc., are likewise sold distinct by the flower-material dealers. The ball-tools above-named, vary from half an inch to an inch and a quarter in diameter; the smaller sizes being used in preparing the rose, poppy, carnation, etc., the largest for the cactus, dahlia, etc. Taking the poppy as a typical example of a flower to be imitated in paper—nine pieces of paper are cut out, with scissors or with some kind of stamp; some notched on the edge, some indented at definite distances apart. These pieces, intended for the nine petals, are gauffered one by one, by drawing up the edges around a finger placed in the middle. They are then threaded together at the centre with a fine wire, and cemented at the proper spots with gum; the heart, bud, leaves, stamens, pistil, calyx, etc., being fixed in their proper places. The wire is covered with green paper of the proper tint for forming the stem, by coiling a narrow

strip around it, the thicker stalks being swelled out by a layer of white carded cotton under the paper. The smaller stalks, to which the buds, leaves, and flowers are attached, are fastened to the larger stalks by silken threads and paper fillets. And thus is a flower poppy built up.

Select any one among a score of the beauties of the flower-garden, and the processes are in a great measure the same, the details only differing in each case. The number of pieces of paper required for the petals, leaves, buds, etc., their sizes and shapes, colors and shades, notchings and indentings, gauffering and crimping, the threading and gumming of the petals, the degree of rolling and unrolling necessary for the full-blown or half-blown condition of the flower, the imitation of the delicate tendrils of certain flowers by means of very fine twisted wire, the imitation in Indian ink of the black markings which occur in the insides of certain other flowers—all have to be attended to, if possible, with real flowers as guiding patterns. Where a flower comprises twenty, forty, or even sixty petals (which is sometimes the case), the building up or mounting calls for the exercise of much tact. For some flowers, such as the camelia, Chinese rice-paper is preferred, on account of its softness and translucency; but being brittle, it requires care and delicacy in handling.

The Six Follies of Science.

THE six follies of science are said to be the following: The quadrature of the circle; the establishment of perpetual motion; the philosopher's stone; the transmutation of metals; divination, or the discovery of secrets by magic; and lastly, judicial astrology. It is perhaps unwise to say that anything is impossible, until the impossibility is demonstrated, but it is certainly not the part of a wise man to attempt the solution of any question by mere hap-hazard guess work. With perhaps a single exception, all the problems above set forth have been proved to be impossible, because they distinctly and unequivocally contradict great natural laws.

Editorial Notes.

Home Arts.

NEARLY every reader of the YOUNG SCIENTIST must have heard of that pleasant little journal—HOME ARTS, the publication of which was commenced a few months before that of the YOUNG SCIENTIST. It was a bright little journal, ably edited and managed by a well-known publisher, whose success with *The Little Corporal* would have seemed to guarantee that of HOME ARTS. But to the everlasting discredit of those who prate about their disgust of low, story-telling papers, (and their number is enough to have supported ten such journals), HOME ARTS never had a subscription list large enough to pay expenses. It has, therefore, been consolidated with the YOUNG SCIENTIST. The following card from the publisher of HOME ARTS tells its own story:

To Subscribers to Home Arts:

As we found the publication of HOME ARTS unprofitable, and could not afford to continue it longer at a loss, we have arranged with the publishers of the YOUNG SCIENTIST to send two numbers of that journal for every single number of HOME ARTS due to our subscribers. Hoping that this will be will be more than satisfactory, and that all our patrons will become permanent patrons to the YOUNG SCIENTIST, we bid them good speed.

PUBLISHER OF HOME ARTS.

In carrying out this arrangement we have adopted the following plan: As the last number of HOME ARTS that was issued was that for November, 1878, it might have been proper to begin with the YOUNG SCIENTIST for December, 1878. As, however, the numbers of the YOUNG SCIENTIST form each year a complete and handsome volume, we have omitted the number for December, 1878, (which would have been an odd one) and have commenced with that for January, 1879. To all subscribers to HOME ARTS, therefore, we have sent as many numbers (commencing with January, 1879) as are due them. Those to whom more than nine numbers are due will receive the numbers due as fast as issued. Those who were subscribers to

both journals will have their subscriptions to the YOUNG SCIENTIST extended by the proper amount.

BOOK NOTICES.

The Workshop Companion: A Collection of Useful and Reliable Recipes, Rules, Processes, Methods, Wrinkles and Practical Hints for the Household and the Shop. Price, 35 cents. New York: The Industrial Publication Company.

There is, probably, not a single reader of this notice that has not at some time or other felt the want of some item of information contained in this book, and would gladly have given the price of the volume for one of the recipes. The book covers a very wide range of subjects, there being no less than ninety main articles, some of which contain as many as sixty sub-headings. The pages are of good size and closely printed in very clear type, so that 164 of them contain an unusual amount of matter. The subjects are arranged alphabetically, the work thus forming an almost complete encyclopædia of practical, everyday information.

The thoroughness with which the book has been prepared is best seen by examining a few special subjects. Turning to the article on *Cements*, we find not only a short treatise on the use of cements, but a series of nearly sixty recipes, covering every possible requirement, from aquaria to steam boilers.

Again, under the head of *Inks*, we find not only a series of recipes for almost every variety of ink, but a carefully written article on the selection and use of ink, giving information which is of service to every one, and which but few people possess. The same might be said of *Alloys, Lacquers, Steel, Brass, Wood Finishing, Polishing Powders*, etc., to the extent of nearly one hundred distinct subjects. In every case, so far as we can judge, the information given is reliable, and its general usefulness is shown by the fact that in almost all cases it covers the popular uses of the articles as well as their strictly technical relations. Thus, under the head of *Marble*, we find not only directions for working and polishing it, but for preserving and cleaning it, and also hints as regards the ways by which marble articles may be injured.

The publishers undoubtedly anticipate for this book a very large sale, or they could not have made the price so low in proportion to the amount of matter given.

Devices of Autumn Leaves.

An exquisite transparency may be made by arranging pressed ferns, grasses, and autumn leaves, on a pane of window-glass, laying another pane of the same size over it and binding the edge with ribbon, leaving the group imprisoned between. Use gum-tragacanth in putting on the binding. It is well to secure a narrow strip of paper under the ribbon. The binding should be gummed all around the edge of the first pane, and dried before the leaves, ferns, etc., are arranged; then it can be neatly folded over the second pane without difficulty. To form the loop for hanging the transparency, paste a binding of galloon along the edge, leaving a two-inch loop free in the centre, afterwards to be pulled through a little slit in the final binding. These transparencies may be either hung before a window, or, if preferred, secured against a pane in the sash. In halls, a beautiful effect is produced in placing them against the side-lights of the hall door. Where the side-lights are each of only a single pane, it is well worth while to place a single transparency against each, filling up the entire space, thus affording ample scope for a free arragement of ferns, grasses, and leaves, while the effect of the light passing through the rich autumnal colors is very fine. Leaves so arranged will preserve their beauty the entire winter.

An exceedingly pretty standing for a lamp can be formed of eight oblong transparencies (made of glass and autumn leaves as described) tacked together with strong sewing-silk so as to form an eight-sided hollow column. To hide the lamp candlestick, the screen should be lined throughout with oiled tissue paper, either white or of a delicate rose-color. A better plan still is to get the effect of ground glass by rubbing each strip of glass on a flat paving-stone, plentifully covered with white sand. This grinding process, of course, must be performed before the leaves are inserted, and then only upon the inner side of the glasses. The completed screen may have a simple border of heavy chenille at the base, or be placed upon an unvarnished black-walnut stand decorated with acorns, pines, cones, etc. The screen is of course left open at the top. It must be set over a lighted candle or small lamp to give its best effect, though it is also a very ornamental object in the daylight.

Curious Experiment.

Suppose you were required to take a coin from the bottom of a deep jar, or even a pail of water without wetting your hand, and suppose further that your naked hand was to be thrust through the water, how do you suppose it could be done? Simply by shaking a little lycopodium, (a substance that may be procured cheaply at any drug store), over the surface of the liquid. Then plunge your hand boldly but steadily into the water and it will not wet you in the least, The cause of the water's not wetting the hand is the same in principle as that which causes the dew to stand in spherical drops on the

cabbage-leaf, and the water to roll off the duck's back without wetting it. By a somewhat similar power, spiders and other insects walk on the surface of water without wetting themselves, and without sinking in the liquid to any perceptible degree.

We have sometimes seen the following solution of this problem offered: Fill a plate with water to the depth of about a quarter of an inch; a coin is then placed in the water; a piece of paper is lighted, and put, while burning, on the surface of the water, and covered with a tumbler. As the paper burns under the tumbler, the water will rush up under the tumbler, and leave the coin in the plate, when it may be lifted without wetting the fingers. This is a very interesting experiment, as it affords a good illustration of the expansive power of heat, and of the pressure of the atmosphere. But when we remove the water by atmospheric pressure, it is after all merely a scientific way of pouring the water out of the plate.

Practical Hints.

Price of Rare Metals.—Dr. Theodore Schuchardt, of Goerlitz, Germany, prepares some of the rarer metals, and charges for them the following prices: cerium, 20 shillings per gram; lanthanum, 40*s*.; didymium, 30*s*. These are in globules obtained by electrolysis. Thorium, in powder, is 36*s*. per gram.

Black Stain for Copper.—Deep black is thus obtained upon cleansed copper: Dissolve 3 or 4 oz. of blue ashes, hydrocarbonate of copper, in a sufficient quantity of aqua ammonia; place the cleansed copper in this solution; cold or tepid, it will be instantaneously covered with a fine black deposit. This coat is so thin that burnished articles look like varnished black.

To Varnish Oak.—First rub well with sandpaper the lengthway of the wood, then take about 2 oz. of raw sienna, 1 oz. of vandyke brown (in water-color), mix with some beer both colors to the thickness of ink (if too dark, let down with more beer), and apply with a painter's sash tool brush, softening off while wet with a larger clean brush of any kind, the lengthway of the wood. The colors can be obtained at any respectable painter's shop. When dry give it a thin coat of oak varnish, and do so again after a few days have elapsed.

Emery Belts and Wheels.—Most users of emery belts and emery wheels do not use glue that is thick enough, fearing it may chill before the sand or emery can be spread. In making an emery wheel or belt, if the cloth has never been glued, it should be sized with glue about as thick as lard oil, and allowed to dry thoroughly before applying the glue which holds the emery. Have the emery heated to 200° Fah., and coat the belt or wheel with glue about as thick as molasses and roll it in the hot emery. If a wheel or belt thus treated is allowed sufficient time to become thoroughly dry it will be very serviceable.

To Preserve Orchids.—The *Gardener's Chronicle* states that M. Thuret, the celebrated French naturalist, has found a saturated solution of common salt to preserve orchid flowers in excellent order, even for as long as sixteen years, and to answer much better than spirits of wine. This fact cannot be too widely made known to persons dwelling in foreign countries, who might thus send home specimens of new medicinal or other plants for description. The editor of that journal recommends the use of flat bottles, and the careful arrangement of the specimens, so that it may be possible to examine them without opening the bottle.

To Improve the Appearance of Furniture. Take a soft sponge, wet with clean cold water, and wash over the article. Then take a soft chamois skin, and wipe it clean. Dry the skin as well as you can by wringing it in the hands, and wipe the water off the furniture, being careful to wipe only one way. Never use a dry chamois on varnish work. If the varnish is defaced and shows white marks, take linseed oil and turpentine, in equal parts; shake them well in a vial, and apply a very small quantity on a soft rag until the color is restored; then with a clean soft rag wipe the mixture off. In deeply carved work the dust can not be removed with a sponge. Use a stiff-haired paint-brush instead of a sponge.

Preparation of a Durable Paste.—Max Regensberg recommends the following method for preventing mucilage, starch-paste, glue or gelatin solutions from spoiling. Any of the above-mentioned solutions or pastes, which should have been prepared with hot rain or distilled water, are mixed with a few drops of ordinary commercial silicate of sodium (silicate of soda) two to three drops for every fluid ounce. The preservative having been added, the mixture is well stirred with a wooden spatula. A solution which has already commenced to decompose may be restored by heating it strongly and adding four to five drops of silicate of sodium for every fluid ounce.

Cutting Caoutchouc.—Dip the knife or cork-borer in a solution of caustic potash or soda; this, although the strength matters little, should not be weaker than the ordinary reagent solution. Water is used in preference to alcohol, which evaporates too speedily. When a tolerably sharp knife is moistened with soda lye, it goes through india rubber as readily as through cork; the same may be said of any cork-borer. By this method inch holes may be bored in large caoutchouc stoppers, perfectly smooth and cylindrical. To insure a perfect finish to the hole, and no contraction of its diameter, the stopper should be firmly pressed against the flat surface of common cork till the borer passes into the latter.

EXCHANGES.

Send to W. S. Beekman, 2 Fountain Pl., Roxbury, Mass., for minerals and chemicals; state what you have for exchange; books, microscopes, chemicals and electrical apparatus wanted.

What offers for Household microscope, darning machine, new 7 shot revolver and box of cartridges, small gold watch, violin and case. J. H. Bell, Tarboro, Edgecombe Co., N. C.

A magic lantern with eight slides, original price $6, to exchange for a gun, telescope, good fishing rod, or revolver. John H. Boies, Box 246, Hudson, Mich.

Wanted, scientific books and instruments; please send list and what you want for them. W. A. Brooks, Jr., P. O. Box 122, Salem, Mass.

To exchange, a seven shot Smith & Wesson revolver, 22-100 calibre, in good condition; state what is offered in exchange. W. B. Flausburgh, La Fargeville, N. Y.

For anything relating to drawing or penmanship, will exchange a new book on fortute telling, and a treatise on chiromancy; 1,750 engravings; price $2. W. C. Gamble, Bothwell, Ontario, Canada.

To exchange, a house swing, cost $3, in good order, for a hammock. Henry M. Haviland, 103 Park Pl., Brooklyn, N. Y.

Wanted, a magic lantern good enough for public exhibition; state what is wanted in exchange. G. W. Kessler, Altoona, Pa.

To exchange, a collection of about 125 rare minerals, each encased in uniform box, accurately labeled, classified and numbered, for telegraph sounder, battery, &c., complete, model engine, microscope or offers. Jos. G. Kitchell, 345 Race St., Cincinnati, O.

A horizontal slide valve steam engine and tubular boiler, cylinder 1¼x2½in., with pump and heater all complete, ready to set up and run; worth $25; for type and accessories for job printing, or offers. Geo. L. Lamson, La Fargeville, N. Y.

Wanted, good nickle rim banjo; have barber chair to give in exchange. C. H Lockwood, South Westerlo, Albany Co., New York.

Wanted, works on natural sciences, phrenology, or physiology, loose or bound numbers of monthlies on science or health, etc., small printing press or microscope; for books or lessons in shorthand. H. C. Lucas, Macomb, Ill.

A good philosophy, 393 pp., will exchange for "American Agriculturist," microscope or book on microscopy. J. Y. Mohler, Middlesex, Cumb. Co., Pa.

A rifle (range 60 rods), gold watch and violin; your choice; a galvanic battery preferred in exchange. Jas. M. Ovenshire, Barrington, N. Y.

Wanted, to exchange all the numbers of "The Cincinnati Artisan," for the year 1879, and three beautiful scroll saw designs, for a small but good dark lantern (bull's eye). E. E. Pinkerton, Afton, Union Co., Iowa.

To exchange for other things, one hundred theological (evangelical) and miscellaneous books. E. J. Rich, Brookfield, Mass.

Wanted, a floor-board planer in exchange for scientific books, microscope or micro-spectroscope, etc. Henry A. Sprague, Charlotte, Maine.

Wanted, to exchange two telephones, a B-flat cornet, an aquarium with fountain attachments, for a pair of telegraphs and keys. W. C. Vick, East Ave,. Rochester, N. Y.

For exchange, two Excelsior, No. 2, printing presses; state offers. W. A. Wilcox, Tunkhannock, Pa.

A book, "Fret Sawing for Pleasure and Profit," by H. T. Williams, cost 50 cts., in exchange for a book of sawing patterns, or offers of similar value. S. B. Wilson, Lenoir, N. C.

PUBLISHER'S DEPARTMENT.

Steel Pens.—A pen, in the course of manufacture, goes through twenty-five different processes, takes four weeks to complete, and yet is offered to the general public by the gross box at considerably less than a cent a pen. It is only by manufacturing pens on so large a scale that they can be produced at prices to meet the demands of competition, and it is only by producing articles of unexceptionable quality that such quantities can be disposed of. The largest manufacturers in the United States are the Esterbrook Steel Pen Company, of Camden, N. J., their warehouse being at 26 John street, New York. Their pens are for sale by all the leading stationers in the country.

Object Lessons for Old and Young.—The influence for good which the Exhibitions of the American Institute have exerted upon the young people of New York and neighboring cities, can scarcely be overestimated. Year after year it furnishes to old and young a series of object lessons unequalled in extent and character. Not only do we find a most extensive collection of interesting products, the newest and best of their kind, but we are enabled to see in many cases the actual process of their production; and this, to many young people, is a sight which cannot easily be found elsewhere, for it is only the privileged few who have the *entree* to factories, workshops and laboratories. We know of no place where our young readers can spend a few hours to greater advantage than in the exhibition of the American Institute.

The House-bell of the Future.—When the modern house-bell, with its meandering wires leading through the most crooked by-paths from mistress to servant, was first substituted for the primitive clapping of hands which is still in vogue in the East, what a wonderful improvement it must have appeared! But even the house-bell has its defects, the most obvious and prominent of which is that it cannot serve to convey a message, but merely to summon the messenger. When, therefore, the telephone was invented, it became obvious that this must speedily displace all wire bells, for here we have the means of imparting a message without the necessity of first calling the servant to us. Half the time and trouble is therefore saved, and as the wires for the telephone can be put up along any wall, and may be twisted and turned round any corner, the great trouble and annoyance attending the putting up of bell-wires and cranks, with the accompanying nuisance of having to bore through partitions, is done away with. The expense of the telephone was at first almost prohibitory, but they are now manufactured and sold by such firms as Kent. Woodstock & Co., 25 Congress St., Boston, at such a low rate that any one may have them. The telephone, therefore, may safely be called the house-bell of the future.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

INDUSTRIAL PUBLICATION

A PRACTICAL JOURNAL OF

HOME ARTS.

VOL. II. NEW YORK, OCTOBER, 1879. No. 10.

French Polish.

HOWEVER much may be said against the brilliancy of French polish and in advocacy of the "dead" finish which of late years has become so fashionable, there can hardly be any question as to the great beauty of a finely finished surface. The grain of the wood comes out so distinctly and beautifully that for ornamental articles, at least, nothing can compare with it. The art is not difficult to learn, though at first the amateur must expect to meet with many failures. There is no secret about the matter, but there is a certain knack which can only be acquired by practice, but which when once learnt is never forgotten. No attempt at scraping, sandpapering or polishing veneered work must be made till the glue is perfectly dry and hard. It should be left twenty-four hours in a warm room at least, and better still if left two or three times as long.

The processes for French polishing vary somewhat according to the nature of the wood. For common work in deal, the wood may be well sized first, then papered with fine sandpaper, and polished.

For mahogany, walnut, and similar porous woods, the pores must be filled by rubbing in, on a roller of old carpet, a mixture of Russian tallow (that is, tallow free from salt) and plaster of paris, well amalgamated—before the fire in cold weather. Russian tallow may be had at most oil shops generally pure enough; but if the presence of salt is suspected, refine it by boiling it in plenty of water, stirring it well, and skimming it. Set it by to cool, and use the cake of tallow which will be at the top.

The more this filling-up process is persevered in, the less will be the subsequent labor in polishing; quite a bright surface should be got up by this alone. The mixture of tallow and plaster may be darkened with red lead for mahogany, or other coloring matter, according to fancy.

This filling is not necessary for boxwood, ebony, or others of the hard woods.

To polish a surface thus prepared, not being hard wood and not in the lathe, take a ball of cotton wool saturated with methylated French polish; cover it with a fold of linen cloth; on the linen cover put with the tip of the finger a drop or two of raw refined linseed oil (not "boiled oil"); get on a good body of varnish by rubbing always one way with circular strokes: be very careful to go over all the ground each time you work round the surface; and do not go over the same spot twice before you have gone over all. The longer this is done the better. Never mind the smears, which, though they look queer, are the very appearance you want at this stage. Having got on a good body, leave your work and take to another piece. It is good to leave it, if convenient, even for a day or two. By the way, shut all doors and windows before you begin. You can't do French polishing in a draft or in a very cold room.

When you resume work, use a mixture of half methylated spirit, or less than half of the spirit when you commence, and put now as little as possible on the wood, covering it with more than one fold of fine linen or cambric. Very little oil, as before —only just enough to prevent the rubber from sticking to the work; go over it lightly, with an easy gentle touch, in circular strokes, all one way. Never mind the smears. When it comes to look something like a good result, which it soon will, you may take out the smears by rubbing up and down with a mere trace of spirit on wool well covered with the linen, but avoid going over the same place twice, and be very light and gentle, or you will remove your polish. Finally, rub it well with a clean wash leather (carefully folded, so as to have no hard crease which will scratch), or an old silk handkerchief, breathing on the work occasionally.

Boxwood, ebony, cocus, etc., may be rapidly polished in the lathe. At first get a body on of polish, and this can be done without using any oil. The work must not be turned round rapidly, but the pulley of the lathe moved slowly by hand; then use your rubber with a drop of oil, and finally, the polish thinned with spirit.

If either on flat or turned work you require a very superior polish, you may remove nearly all the first coat with fine sandpaper, and put it on again, which will not take long, the pores being all filled. Remember that throughout, the oil is only used to prevent the rubber from sticking, and it has to be got out afterwards with the spirit; so never use more than necessary.

In the lathe, when you come to the wash leathers, the work may be driven rapidly. A bit of ebony can be polished in five or six minutes to such a surface that small print can be easily read in it as in a mirror. Don't use your rubbers when they get hard and dry, but nevertheless stick to an old one as long as you can, and if you have to put them by, keep them in a tin box tightly covered.

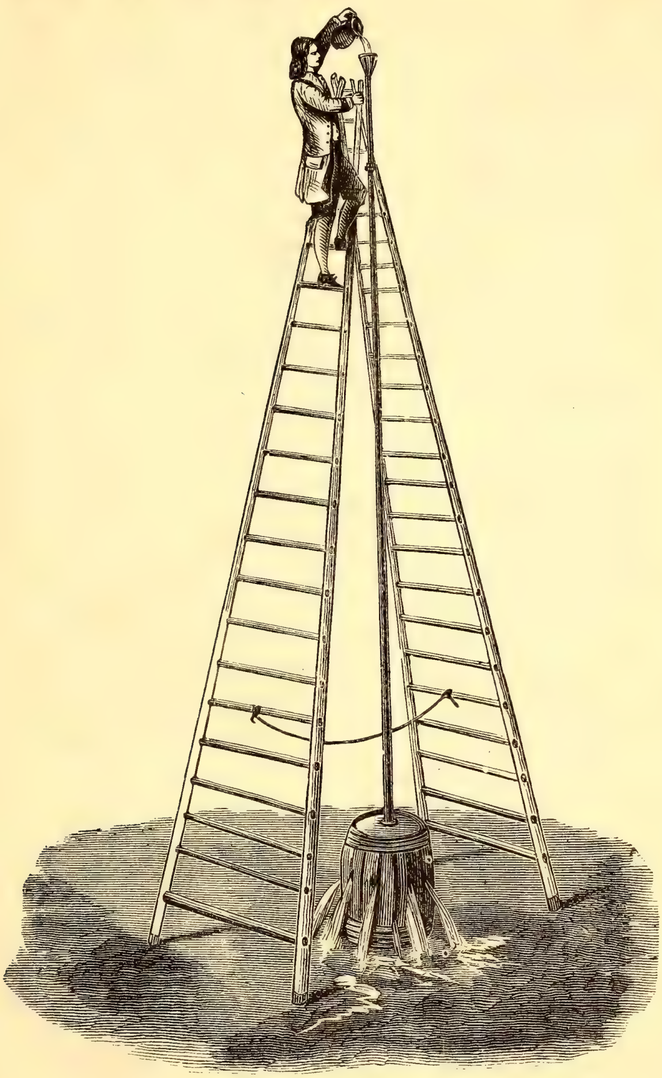
A Lesson in Hydrostatics.

BEGINNERS in science are often frightened with hard words and think that because a subject has a long, hard name like hydrostatics, therefore, it can have no relation to ordinary everyday occupations. But just as the countryman in the French play had talked prose all his life without knowing it, so every good housekeeper concerns herself with hydraulics, hydrostatics, pneumatics, etc., without being aware of the fact. It will not be difficult to find many illustrations of hydrostatics in ordinary household work. But first of all let us examine the engraving on the opposite page, and learn what it teaches us.

The experiment which this figure illustrates is one that it is not difficult to repeat. A good stout barrel, known to be watertight, has a long pipe secured to its head as shown in the figure. The cask may now be filled with water until the liquid stands two or three feet high in the tube, and it will then be easy to see whether or not the cask leaks. If everything is sound, pour another pitcherful of water into the tube, and unless the cask is very much stronger than those usually made, the hoops will burst and the water pour out of the openings between the staves.

The astonishing feature of this experiment is the very small weight of water that

is required to burst the cask. A few pounds at most are all that need be used, and strange to say—*the larger the cask the more easily will it burst!* The latter is a exerts a pressure of so many pounds per square inch for every foot in height that it stands. If this pressure be 10 lbs. on each square inch and there are 10 square



A LESSON IN HYDROSTATICS.

fact that very few can believe until after they have carefully studied the subject, but it is very easily understood when the correct view of the matter once presents itself to the mind. The water in the tube inches then the whole pressure is 100 lbs; if there had been 100 square inches the pressure would have been 1,000 lbs. Hence the greater the number of square inches the greater is the pressure on the vessel,

and therefore, the larger the cask the more easily can it be burst.

A few days ago a very striking illustration of this principle came under our observation. A lady who had just received some new cider thought she would like to bottle some. She had seen cider successfully kept in small bottles—why would not a large demijohn be stronger and better? So the demijohn was filled with cider and the cork tightly inserted. In a few minutes the cider had worked so as to create quite a pressure within the vessel and out flew the large cork with a loud report. This, however, was easily remedied. The cork was driven in again and tied tightly down. Before long, however, another report was heard, and this time the demijohn itself flew to pieces and the cider was scattered over walls, ceilings and carpet.

Now, if instead of one large demijohn, this lady had taken a dozen small bottles, it is not likely that the cider would have burst them. Numerous illustrations of this principle are seen all around us. A small gun, with sides not one quarter the thickness of boiler-plate, will resist a pressure which would completely wreck a large steam boiler.

Scroll Sawing—IV.

BY F. T. HODGSON.

AT this stage, the young student will think himself sufficiently advanced to make a bracket; but I would advise him not to attempt it just yet, as failure to make a neat one will surely be the result; and failure is always discouraging to a beginner. In place of making a bracket, it would be better to practice cutting out letters similar to the ones shown below. They can be cut out of the sides of cigar boxes until a state of proficiency is reached that will warrant an attempt being made in more valuable woods.

If letters similar to the ones shown, are made of thin holly, and skillfully cut out, they may be put to many useful and ornamental purposes. For instance, take a piece of fine scarlet or crimson cloth and use it for a back ground, then take clean cut letters and glue them neatly on the cloth, forming the motto, "Home Sweet Home," or any other appropriate sentiment that may be fixed upon. When this

A B C D E F G H

is done, design a neat border with corresponding corner ornaments, cut out of holly and glue round the cloth, mitering them properly at the corners. This will make an ornament far more handsome if skillfully done than any bracket that could possibly be made at this stage. The fancy can roam a little even in the cutting of these letters, for the H, S, H, may be made larger and more ornamental than the intervening letters, and a spray of ivy or maple leaves may be interwoven through the whole motto; but this can only be done successfully by a good hand.

Letters may also be employed when neatly cut, on glove-boxes, work-boxes, and dozens of other things; and I can assure the pupil that no practice will give him such a mastery over the saw as that of cutting letters of various styles. The letter S contains all the curves, kinks, and angles, that will ever be met with in the whole range of fret-sawing.

A bracket may now be attempted—a small one first—it would be better to make it of some cheap material, such as pine, walnut, or white wood. A simple design, similar to Fig. 17, will be the best to adopt

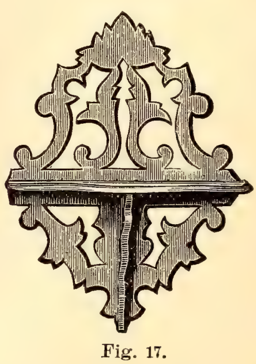


Fig. 17.

at first, bearing in mind to make all the inside cuts first. Of course, it will be necessary to bore a small hole through the bracket in every part that requires to be removed from the inside. These holes are

made to admit the blade of the saw to pass through.

If the pupil is a pretty fair hand to draw, he may be able to make his own designs, if not, it is better to purchase them in sheets, as they can be obtained at very reasonable rates; and where it is desirable to preserve any particular design, it may be done by first pasting the original design on a thin piece of stuff, then taking another piece of thin stuff and inserting a flat piece of zinc between them and sawing all three together, being very careful to follow the lines of the design closely, for any defect in the sawing will be a permanent one in the pattern. There will be no difficulty in cutting the zinc; use a No. 3 saw, feed slowly and you will be astonished at the result. This is the best way I know of for saving a valuable pattern, as the zinc will not break or change its shape. When the sawing is finished, there will in all probability be a few rough edges and crooked corners; to remedy these use your files and sand paper, being careful not to file down any of the angles. The under edges will be somewhat ragged, but a proper application of sand paper will make them smooth.

The next thing will be to put the work together, which, with some young folks, is a more difficult job than to saw it, but any one having the smallest amount of constructive ability, will be able to put the work together without much trouble. If the bracket is intended to carry books or other heavy articles, it is always better to put it together with screws and glue; if, however, light articles only are to be placed on the shelf, brads and glue will be all that will be required to fasten on the shelf and sustaining bracket. The shelf and sustaining bracket should always be thick enough to admit of small screws being used in them to fasten them together.

Fig. 18 is a more elaborate bracket than the preceding one and will require more care in cutting, but the pupil, after satisfactorily finishing the bracket shown at Fig. 17, can safely be trusted to saw this or any similar one. Further examples of brackets are unnecessary, as these cuts are too small to be of much service to the amateur without being enlarged; and are only intended to aid him in choosing such designs as may be useful to him in mastering the saw.

It is supposed now, that the pupil is fully competent to cut any kind of bracket, therefore, it is time he should try his hand

Fig. 18.

at something else; so at Fig. 19 he is shown a small frame for a photograph, which is to be cut in holly or walnut; it is

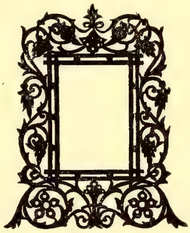


Fig. 19.

very neat and will try the patience and ingenuity of the sawyer, but perseverance and love of the work will soon overcome any little difficulty that may occur.

In the next issue I will take up the subject of inlaying, as the pupil is now sufficiently advanced to make an attempt, with fair chances of success, of doing some handsome work in this department.

Straight Edges.

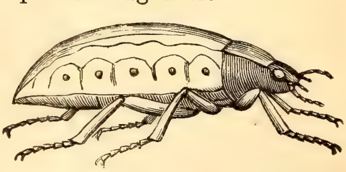
PERFECT accuracy of outlines is of the highest importance in the construction of all machines and parts of machines. The amount of care requisite to the production of a good straight edge, or surface plate, is very great. The means by which this accuracy is attained are somewhat as follows:

Three pieces of mahogany, or other hard wood, about three feet long by a quarter inch thick, are planed up as truly as possible, the planed surfaces of all three being from time to time applied to one another,

in order to judge of the trueness to which the surfaces are being reduced. When any one of three prepared surfaces will lie on the prepared surface of either of the other two without allowing any light to pass through the line of junction, the edges may be considered sufficiently true to admit of their being used in the production of a metallic straight edge. To this end three similar strips of steel, of the size desired, are smoothed or cleaned upon their sides on a grindstone or with a file. They are then laid one upon the other, and a hole drilled at each end, a rather tight-fitting pin or rivet being run through each hole to keep the three bars together. In this state they will appear as one thickish bar. The compound bar being placed in the vice and clamped on each side with sheet lead or zinc, the edges are filed level, beginning first with a rough file, and gradually increasing in fineness. Every now and then the edge being produced is tested against one of the wooden edges above described, which should be previously rubbed over with red chalk, etc., to render prominences visible. When the eye no longer detects any differences in level on the application of the wooden straight edge, the steel pieces are to be removed from the vice, and pins extracted. They must now be tested against one another, until, by careful filing and repeated comparison with one another, it is found that the edges of all three will unite closely without any irregularity being perceptible. A good way of ascertaining whether any such exists, is to place two edges in contact and rub them together with some force; the prominent portions will by this treatment be somewhat burnished, and will render themselves apparent by their superior lustre. The reason why three edges should be prepared simultaneously will be sufficiently evident on reflection. It will be readily understood that if A and B were two strips of steel, that A might be slightly concave and B correspondingly convex, without the eye being able to detect any fault, as no light would pass: but if a third strip, C, having the same convexity as B, were applied against the latter, the fault would immediately become apparent, and on correcting the faults of B and C, and applying them to B, the concavity of this latter would also be rendered visible.

How Insects Breathe.

THE fact that we ourselves, and all the larger land animals with which we are acquainted, breathe through the mouth and nostrils, has led most people to think that insects too breathe through the mouth. Ask those who have not made a special study of insects, how the fly breathes, or, rather, at what point of its body it takes in the air, and it is ten chances to one that you will be told that it breathes through the mouth. The insect, however, does not breathe through the mouth, but through a series of openings placed along the side. In many flies and small insects these openings are invisible to the naked eye, but in some of the larger beetles and in most caterpillars they can be readily distinguished without the aid of a microscope. The common cockchafer or May-bug in the larval or caterpillar state shows these breathing pores or spiracles very clearly. In the white caterpillar they appear as a row of dark brown dots down the side. When viewed with a low power (25 diameters) these dots are seen to be oval openings, partially shielded from dust, etc., by minute hairs. In the beetle their position is shown in the engraving, the hard wing cases having been removed so as to uncover them. They can be clearly seen with a pocket magnifier.



BREATHING PORES OF BEETLE.

These spiracles form very curious and interesting objects when mounted for the microscope. The skin of the caterpillar may be soaked in weak potash solution so as to remove the grease and render the substance transparent. It should then be washed in water, afterwards in the strongest alcohol, and after that it should be soaked in spirits of turpentine. When

thoroughly saturated with the latter it should be mounted in Canada balsam.

From caterpillars it is easy to procure not only the spiracles but the connected air tubes or tracheæ. These form very beautiful objects when perfectfy dissected and well displayed. The best method of preparation is to slit the caterpillar open along the under side and soak it in acetic acid. After a day or two the entire system of tracheal tubes may be separated by means of fine needles, and after washing with water, and soaking in alcohol and turpentine, they may be mounted in balsam—or after washing with alcohol they may be mounted in glycerine.

Notes on my Cabinet.

THE microscope is not only a means of education and a tool for accomplishing valuable practical work, but, also a source of great pleasure and amusement from the endless variety of beautiful and curious things which it enables us to examine. And, although many scientific men look down upon such a use of the instrument, to my mind it is one of great value and usefulness. An evening spent over the microscope, even by those who have but little scientific knowledge, tends to elevate and improve.

Nothing tends so much to enhance the pleasures of such an evening as a good supply of interesting slides or objects. They need not be very costly or even of much scientific value; if they show the objects well and bring out clearly a few important points, it is all that is required. But, in order to get the greatest enjoyment out of such an evening, it is necessary that we should have something which will exercise our minds as well as our eyes.

I make no pretensions to being a microscopist, and the instrument which I use would probably be ridiculed if introduced at any of our modern microscopical exhibitions. But, by means of it I have been enabled to give a great deal of pleasure to friends, young and old, and, perhaps, a few leaves from my experience may not be unacceptable to readers of the YOUNG SCIENTIST.

Some objects can only be kept on hand when carefully mounted on glass slips. This is the case with different kinds of blood and with all objects which are difficult to procure, and which require much time for preparation. But I have always found that the objects which give the most pleasure to a gathering of a few friends are not the finely mounted slides but those common objects which are easily found, easily prepared, easily mounted, and easily shown. A few evenings ago some friends called at my house, and out came the inevitable microscope. I first showed them some slides of diatoms and other scientific things which pleased them much, and greatly excited their wonder when they came to see that the large and elaborately carved shells which were so beautiful under the microscope were entirely invisible to the unassisted eye. But, after all, there was a kind of feeling as if the microscope had *made* these things, not as if it merely enabled us to see things that were already in existence and which merely required keener vision to render them sensible. After a while, however, a lull took place in the exhibition, and the conversation wandered off to other matters. One lady incidentally mentioned that she had purchased, very cheaply, some material which was warranted all wool, but which she feared was partly cotton. As she had the stuff with her I suggested that it would be very easy to settle the question by an appeal to the microscope. So a little of the fabric was cut off, placed on a slide, and teased out with common needles stuck in pine handles. It was then moistened with a little glycerine and water and covered with a thin glass. On placing it under the microscope it was at once seen that the material was, at least, three-fourths cotton, and this was so obvious to every one that looked at the object, that the utmost surprise and pleasure was shown by all. No diatom, however beautiful, could have excited the same interest as these few fibres of cotton and wool.

In my next letter I will tell my readers something more of these appearances and describe to them the best way of examining such objects.

O. W.

Too Much Philosophy.

SOME people are always ready with a theory for every phenomenon. In general they depend upon "electricity" for a solution of any problem which presents itself, but as this has of late been run into the ground, they resort to new spectroscopic theories for the heat, or in severe winters to gulf-stream theories for the cold. A gentleman who had a great contempt for such theorists, and who expected a visit from some of them, had in his garden one of the well-known carboys, or globular bottles of dark glass, in which sulphuric acid had been kept. Such bottles form a mirror in which the surroundings are seen reflected on a very small scale, and might be looked upon by some as heat concentrators. The bottle was lying on the ground in the sunshine, and the professor made his guests observe that singularly the upper side, exposed to the sun, was not so hot as the lower side. At once a few of the learned friends said that of course this must be so, because the dark glass was very transparent to the caloric rays, which, therefore, did not heat it, but passed through and were absorbed under the bottle by the ground, which then heated the under side of the bottle by conduction. Others held that the form of the bottle was the cause; the upper side being convex, distributed the rays by reflection, while the under side being struck by the rays on its concave surface, concentrated them. A few other theories were propounded, to none of which our professor agreed, when finally his friends insisted that he should give an opinion as to the cause of the bottle's being hotter below than above. He said that he had turned it round, upside down, just when they entered the garden.

Editorial Notes.

To Our Subscribers.

THE confusion attendant on certain changes in our location and business, and the failure of certain parties to furnish articles and illustrations for which we had contracted, caused some delay during the summer months which proved very annoying to our subscribers and to ourselves. There are two numbers more required to complete the volume, and they will be issued without delay. Our arrangements now are such that the YOUNG SCIENTIST will be issued hereafter regularly and promptly. It is the only journal of the kind in the world, and we hope our young friends, and old ones too, will help us to make it better. This can only be done by aiding us to secure as many new subscribers as possible. Let each boy and girl try and get us one new subscriber and the YOUNG SCIENTIST for 1880 will be a glorious success. And to encourage them to do this we would call attention to the liberal premiums which we offer.

Who Wants a Knife?

EVERY boy wants a good knife and no lady's work-basket is complete without one. We have just purchased, at a great bargain, a few very excellent pocket knives of Sheffield manufacture. We have tried these knives and they are really good, notwithstanding the fact that we bought them so low that we can give one to each of our subscribers who will send us $1.00 for his own subscription and that of some one not now a subscriber.

These knives are of three different kinds. One is for boys; it is a stout knife with two blades and buck horn handle; one blade is large and strong for whittling; the other is small. The second knife is lighter; it has a large and a small blade, and the handle is of dark cocoa; it is an excellent knife for the vest pocket and for light work. The third knife is quite small; it has two blades and a white handle with name plate on it. It is a lady's knife rather than a boy's. Those who secure one of these knives as a premium can take their choice of any of the three.

In addition to these knives we have the following, which are marvels of cheapness. No 1 is a sportsman's knife with stag handle. It has the usual blades with corkscrew, picker, gimlet, etc. Such a knife usually sells for $1.50, and we offer it to any one who will send us three subscriptions—two of which must be new names.

No. 2 is a very handsome knife with tortoise-shell handle and three blades. It is specially suited for ladies, and is a very beautiful article. A cutler on Broadway asked us $1.75 for a similar knife. We offer it for 5 subscribers, four of whom must be new.

No. 3 is a very pretty penknife with two blades—the handle inlaid with mother of pearl. This we offer for 3 subscribers—two of whom must be new.

Designs for Scroll-Sawyers.

MR. HODGSON, whose admirable articles on scroll-sawing are now in course of publication in the YOUNG SCIENTIST, has prepared for us a series of seventeen designs covering a great variety of subjects suitable for Christmas presents and ordinary articles of household ornament and utility. These designs we have had photo-lithographed and printed on two large sheets. They are full size and embrace over forty different pieces. Knowing that this set must have a large sale, we have placed the price at 25 cents for the set, or a cent and a half for each design. We know of no designs equal to these which can be had for less than five, ten, or twenty cents each.

To any boy or girl who will send us a new subscriber, (together with their own subscription) we will send a set of these designs free. The subscriptions may be for 1878, 1879, or 1880. Remember, one of the subscribers must be new. It will not do to send a renewal of the subscription of an old subscriber.

Relacquering Brass.

Articles which have been lacquered before are easily cleaned by boiling them in pearlash, when the old lacquer will be destroyed, though it will perhaps still lie upon the surface as a whitish kind of varnish. To remove this, and restore the articles to their proper color, let them be soaked in a solution of aquafortis and water, and then suffered to remain some hours, according to circumstances. The acid eats away the outer coat, leaving a bright surface beneath. The goods are now put in bran, and then shaken about to dry and clean them, when they will be ready for lacquering again, which is done as follows, in two ways, called cold lacquering and hot lacquering: by the former, a little lacquer being taken on the brush (a common camel hair varnish one), it is laid carefully and evenly on the work, which is then placed in an oven or on a hot stove; the heat from this continued only a minute or two is sufficient to set the lacquer, and the work is finished. By the second method the work is heated first to about the heat of a flat iron as used by the laundress, and the lacquer quickly brushed over it in this state, the work being subjected to the oven for a minute or two afterwards, or not, according to the pleasure and judgment of the lacquerer. The article, if very small, will require this, because it will have parted with most of its heat in laying on the lacquer; if heavy it will retain sufficient to perfect the process. The greatest difficulty is to know the exact degree of heat, and this cannot be attained except by experience, so different is the nature of the materials, the quality of different lacquers, and the effect to be produced. The following recipes for lacquer have been found by experience to give good results and a considerable range of color. 1. Seed-lac, dragon's blood, annatto, and gamboge, of each 4 ounces; saffron, 1 ounce; spirits of wine, 10 pints. 2. Turmeric, 1 pound; annatto 2 ounces; shellac and gum juniper, of each 12 ounces; spirits of wine, 12 ounces. 3. Seed-lac, 3 ounces; amber and gamboge, of each 2 ounces; extract of red sanders, ½ drachm; dragon's blood, 1 drachm; saffron, one-fifth drachm; spirits of wine, 2 pints 4 ounces. 4. Turmeric, 6 drachms; saffron, 15 grains; spirits of wine, 1 pint 4 ounces; draw the tincture; add gamboge, 6 drachms; gum sandarac and gum elemi, each 2 ounces; dragon's blood and seed-lac, of each 1 ounce. 5. Put into a pint of alcohol, 1 ounce of turmeric powder, 2 drachms of annatto, and 2 drachms of saffron; agitate during seven days, and filter into a clean bottle: now add 3 ounces of clean seed-lac, and agitate the bottle every day for fourteen days. 6. *Pale brass lacquer:* Alcohol, 4 gallons; cape aloes (small), 6 ounces; pale shellac, 32 ounces; gamboge, 2 ounces; dissolve.

Autumn Leaves.

America is unrivalled for the gorgeous colors of her autumn foliage, and many of our young readers, no doubt, take great pleasure in collecting autumn leaves, pressing them and arranging them in bouquets. The great difficulties to be contended against are that leaves are apt to curl and to become so brittle that they break very easily. We give the experience of two correspondents of the *Household* who seem to have had specially good success.

One says: "Press the leaves between the pages

of an old book, allowing them to remain until perfectly dry. Then rub a little boiled oil over the surfaces of the leaves, and place them to dry where the dust will not settle on them. Boiled oil is preferable to wax because it renders the leaves tough and flexible instead of brittle, while it gives them the same beautiful glossy appearance. Mine that were prepared in this manner last autumn are still on the walls, mementos of the dear mother that placed them there, who has since been summoned to that land where all that is beautiful is unfading."

The other gives her experience as follows: "I press them two weeks perhaps, or until thoroughly dry; then varnish them on the right side only, and lay on a board in a dark room to dry. I never have them curl or break when thus prepared. Ferns, when pressed, become beautiful ornaments in a few days, (do not press them too long or they become brittle,) and then paint them with a mixture of paris green and varnish; I wish you could see my wreath of autumn leaves and ferns."

Those who use Paris green for this purpose must be cautioned that it is a deadly poison. Never work with this substance in powder as the fine dust, when inhaled, may give rise to serious trouble. If mixed with oil or varnish so as to be moist there is less danger.

Punching Holes in Straps.

Boys who have occasion to punch holes in their skate straps, or straps for carrying books, etc., will find the following hints valuable:

The punching of holes through the various straps of harness, for buckle tongues, and for attaching the buckles, is a matter of considerable importance, and does not, as a rule, receive the attention that it should. The old method, of punching them from the upper or grain side of the leather, has been generaly abandoned by the manufacturers of fine work, it being deemed injurious to the wear of the leather. The principal objection arises from the liability of the grain of the latter to crack from the strain of the buckle-tongue, and to be the cause, eventually, of the leather tearing, as it causes such a crease where the tongue catches, that it injures the texture of the leather, and makes it tear the hole more or less In addition to this, if the leather is very strong, the tongue of the buckle is sure to bend out of shape. All these objections can be obviated by punching from the under or flesh side of the strap, and by using a punch, the long sides being parallel with the length of the strap; the punch should be set at an angle of about twenty degrees, cutting the hole at such an angle that the buckle-tongue will rest in it without throwing any strain on the inside of the leather. Some object to punching the hole from the under side on account of its forcing the grain out, and thus disfiguring the outside edges of the hole. This can be corrected, however, by driving the punch through the hole from the outside, which will cut away the slightly turned edge of the grain, and set it down smooth and clean. It is not necessary, however, to re-punch any holes except those that will be exposed when the harness is complete. Punches should be as thin as possible, as the extra thickness of the metal strains the leather.—*Harness Journal.*

Call for Telephone.

A correspondent of the *Scientific American* gives the following method of making a call for a string telephone. Suspend the telephones at each end, so that the line string (the string connecting the diaphragms) may be kept tightened. and free to transmit vibrations from either end, Now rub some resin on the line string at each end; and when you wish to signal the other, rub along the resined part of the string, and quite a loud noise will be heard in the telephones at each end, sufficient to be heard anywhere in the room. It is on the principle of the boy's "rooster," consisting of a resined string passed through one end of a tin can. Petroleum may be used instead of resin with equally good results. This kind of call does away with electric bells and other contrivances for acoustic lines. If ferrotype plate and fine wire take the place of the parchment diaphragm and strings, the same call may be used by fixing to the wire a piece of resined string, the call being effected as before by rubbing on the string.

To Imitate Japan-Work Boxes, etc.

A very effective style of ornamenting cabinets, window boxes, tables, etc., is that by which the figures of the design are made to stand out in relief upon a black or coral ground, afterward highly polished like Japanese lacquer-work.

A preparation is first made by dissolving the best white beeswax in spirits of turpentine until it is of the thickness of copal varnish. This may be kept in a bottle until you are ready to begin the work, when you may pour out a small quantity and mix into it a little flake-white sufficient to give it a body. Now, with a fine sable pencil, trace accurately the design on the white wood, which has been first made very smooth and clean, and go over every part of the pattern, leaving only the ground-work untouched. When this is well dried, mix ivory-black with parchment size, thus forming a very black kind of paint. Go over the entire surface with this paint, or, if it is intended to give it a coral-col-

ored ground, use the sealing-wax varnish made by dissolving red sealing-wax in spirits of wine. Let the whole get thoroughly dry; and if it is not well covered give it another coat.

When this is dry, let the whole work be brushed with a bristle brush dipped in spirits of turpentine, and rubbed pretty hard until the parts covered with the white mixture are left bare. The designs first traced will now become visible, with sharp, clear outlines marked on the black or red ground, and will look very handsome. It must then be varnished with white varnish, and rubbed down with pumice powder until very smooth.

Practical Hints.

Removal of Iron-stains from Linen.—"Salts of tin" are said to be better for this purpose than oxalic acid.

Shaping Soft Rubber with a File.—Prof. Morton, of the Stevens Institute, states that he finds the ordinary thick sheet rubber, used in making up lantern tanks, and for many similar purposes, may be readily dressed into an exact shape with a file, if only it is supported by being clamped between plates of wood or metal in a vice. The file is used dry, and in all respects as in working on wood or metal.

Green Bronze.—Dissolve 2 oz. of nitrate of iron, and 2 oz. of hyposulphite of soda, in 1 pint of water. Immerse the articles in the bronze till of the required tint, as almost any shade from brown to red can be obtained; then well wash with water, dry, and brush. One part of perchloride of iron, and two parts of water mixed together, and the brass immersed in the liquid, gives a pale or deep olive green, according to the time of immersion. If nitric acid is saturated with copper, and the brass dipped in the liquid, and then heated, it assumes a dark green. If well brushed, it may be lacquered with pale gold lacquer, or else polished with oil.

Waterproof Dressing for Leather.—The Boston Laboratory gives as a waterproof dressing for boots, shoes and leather the following: Lard oil, 100 parts; paraffin, 50 parts; beeswax, 5 parts. Gently warm the oil and in it dissolve the paraffin and wax. If too hard, use a little less wax. Any disagreeable smell may be removed by a few drops of oil of sassafras. The wax prevents the crystallization of the paraffin, and the oil causes the whole to become a paste of the consistency of tallow. The dressing fills the pores of the leather, does not dry, but keeps the leather soft and pliable. Boots and shoes to which the dressing is applied may be polished, using ordinary blacking, which is not the case with most dressings containing oil or grease.

Waterproofing Linen.—Professor Kurr gives the following directions for this purpose: Pass the linen first through a bath of one part sulphate of alumina in ten parts of water, then through a soap bath, of which the soap is prepared by boiling one part of light-colored resin and one of crystalized carbonate of soda with ten parts of water until the resin is dissolved. The resin soap thus formed is to be separated by the addition of one-third of common salt. In the soap bath the resin soap is dissolved, together with one part of soda soap, by boiling it in thirty parts of water. From this bath pass the articles finally through water, then dry, and calender. Made-up articles may be brushed with the solutions in succession, and be rinsed in the rain. Wooden vessels may be employed.

Working Ash.—Steam is the ordinary means used to soften ash, but when it is practicable, boiling in water is the best. The chief thing is to have the right kind of ash, as some kinds bend and others do not. One tract of land may furnish the best of ash, while another, lying close by and having just as good a soil, may produce only an inferior quality. The timber must be heavy and tough, and cut from good trunks. No matter if it has been cut and dried three years. A splinter of this quality of ash can scarcely be torn off, and runs the whole length of the wood before it ceases. Half an hour's boiling is sufficient to soften a piece of wood six centimeters thick. When the wood is taken out of the kettle, put it in the brace, screw and wedge it in the desired form without relaxing, and let it cool a few hours. After the wood is thoroughly dried in the brace, unscrew it and take out the wedges; it will always then retain its form.

EXCHANGES.

Unmounted objects ready to mount, including diatoms, spicules, sections, foraminifera, polycystina, starches, insects, algæ, zoophytes, etc., for other mounted or unmounted objects. S. N. Hardy, Victoria, Cass Co., Neb.

Bird's eggs wanted. Have in exchange old U. S. coins and other articles. Address E. W. Humphreys, Woodstown, N. J.

Wanted, Scott's revised list of all postage stamps and stamped envelopes, cost two dollars and a half; for sixteen numbers Magazine of Art, cost four dollars; or books. E. H. Jenkins, Rockland, Mass.

Wanted, good illustrated works on entomology and ornithology; also specimens of natural history, and curiosities for a collection; stuffed birds given in exchange. Geo. C. Jones, Brookfield Center, Fairfield Co., Connecticut.

A number of magic lantern slides wanted; state what is wanted in exchange; will give a good trade. Samuel J. Jones, Box 137, Oxford, N. C.

Wanted, good telescope, 2 to 3½ inch aperture; state what is wanted in exchange. Edward B. Porter, Indiana National Bank, Indianapolis.

Wanted, a good wood lathe, or encyclopædia, or other good books and tools; in exchange for a Bickford Knitting Machine complete; make offers. F. M. Snyder, West Dryden, Tomp. Co. N. Y.

Back numbers of Young Scientist for 1878, a telegraph instrument worth $10, and two books on phonography, (Mrs. Burn's Text-Book and a reader), worth $1.50, in exchange for geological specimens, scientific books, or offers. Robt. E. Stackpole, 2 Varick Place, N. Y. City.

Practical instruction in Takigrafy, or Lindsley's Phonetic Short-Hand, will be given in exchange for good books; a microscope, or guitar worth from $5 to $10. Takigrafer, Box 150, New Haven, Oswego Co. New York.

$22.00 telescope, orchestra B-flat cornet. 5 crooks, and box, Fleetwood scroll saw with boring attachment and 2 doz. saws, cost $26; exchange for printing press and type. Manager W. U. Tel. office, Lanesboro, Susqa. Co., Pa.

Send to W. S. Beekman, 2 Fountain Pl., Roxbury, Mass., for minerals and chemicals; state what you have for exchange; books, microscopes, chemicals and electrical apparatus wanted.

What offers for Household microscope, darning machine, new 7 shot revolver and box of cartridges, small gold watch, violin and case. J. H. Bell, Tarboro, Edgecombe Co., N. C.

A magic lantern with eight slides, original price $6, to exchange for a gun, telescope, good fishing rod, or revolver. John H. Boies, Box 246, Hudson, Mich.

Wanted, scientific books and instruments; please send list and what you want for them. W. A. Brooks, Jr., P. O. Box 122, Salem, Mass.

To exchange, a seven shot Smith & Wesson revolver, 22-100 calibre, in good condition; state what is offered in exchange. W. B. Flausburgh, La Fargeville, N. Y.

To exchange, a house swing, cost $3, in good order, for a hammock. Henry M. Haviland, 103 Park Pl., Brooklyn, N. Y.

Wanted, a magic lantern good enough for public exhibition; state what is wanted in exchange. G. W. Kessler, Altoona, Pa.

A horizontal slide valve steam engine and tubular boiler, cylinder 1¼x2½in., with pump and heater all complete, ready to set up and run; worth $25; for type and accessories for job printing, or offers. Geo. L. Lamson, La Fargeville, N. Y.

Wanted, good nickle rim banjo; have barber chair to give in exchange. C. H Lockwood, South Westerlo, Albany Co., New York.

To exchange, a collection of about 125 rare minerals, each encased in uniform box, accurately labeled, classified and numbered, for telegraph sounder, battery, &c., complete, model engine, microscope or offers. Jos. G. Kitchell, 345 Race St., Cincinnati, O.

For anything relating to drawing or penmanship, will exchange a new book on fortune telling, and a treatise on chiromancy; 1,750 engravings; price $2. W. C. Gamble, Bothwell, Ontario, Canada.

Wanted, works on natural sciences, phrenology, or physiology, loose or bound numbers of monthlies on science or health, etc., small printing press or microscope; for books or lessons in shorthand. H. C. Lucas, Macomb, Ill.

A good philosophy, 393 pp., will exchange for "American Agriculturist," microscope or book on microscopy. J. Y. Mohler, Middlesex, Cumb. Co., Pa.

A rifle (range 60 rods), gold watch and violin; your choice; a galvanic battery preferred in exchange. Jas. M. Ovenshire, Barrington, N. Y.

Wanted, to exchange all the numbers of "The Cincinnati Artisan," for the year 1879, and three beautiful scroll saw designs, for a small but good dark lantern (bull's eye). E. E. Pinkerton, Afton, Union Co., Iowa.

To exchange for other things, one hundred theological (evangelical) and miscellaneous books. E. J. Rich, Brookfield, Mass.

Wanted, a floor-board planer in exchange for scientific books, microscope or micro-spectroscope, etc. Henry A. Sprague, Charlotte, Maine.

Wanted, to exchange two telephones, a B-flat cornet, an aquarium with fountain attachments, for a pair of telegraphs and keys. W. C. Vick, East Ave,. Rochester, N. Y.

For exchange, two Excelsior, No. 2, printing presses; state offers. W. A. Wilcox, Tunkhannock; Pa.

A book, "Fret Sawing for Pleasure and Profit," by H. T. Williams, cost 50 cts., in exchange for a book of sawing patterns, or offers of similar value. S. B. Wilson, Lenoir, N. C.

PUBLISHER'S DEPARTMENT.

Amateur Printing.—Although the art of printing, in its higher departments, is one of the most difficult and exacting, nothing is easier than to turn out passable work, and this, too, with presses which at first sight would seem to be incapable of such results. With the small printing presses which are now so numerous in market, it is quite possible to turn out cards, labels, and work of that kind quite as good as the ordinary work of the job printer. And it is not difficult to learn how to do it Amateur printing is perhaps one of the most fascinating and useful of the many pursuits to which young people devote themselves. And it is a wonderful educator. Nothing teaches a boy how to spell and punctuate like the printing press. In addition to all which it is a profitable amusement, for we have known many boys who keep themselves liberally supplied with pocket money by means of their little printing presses. Those who desire to set up an amateur printing office would do well to send to John Metz, 32 Beekman St., N. Y., for a copy of his catalogue, and if they are in town it would be advisible for them to examine his stock.

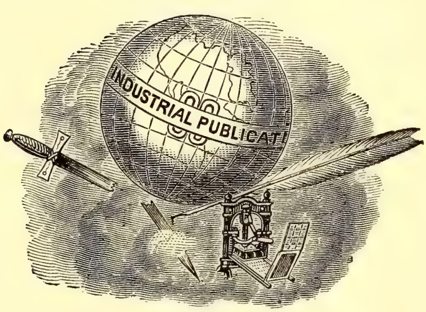
THE

Young Scientist.

A PRACTICAL JOURNAL OF

HOME ARTS.

"KNOWLEDGE IS POWER."



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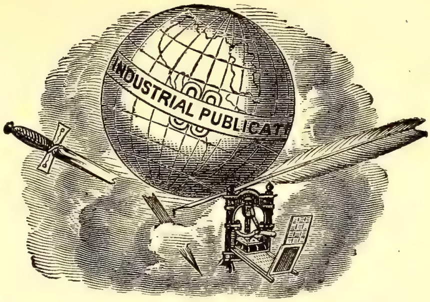

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Home-Made Telescopes and Microscopes.—I.

THERE is probably no art that gives so much pleasure to the young beginner, or that excites so much wonder and applause amongst his friends, as that of making optical instruments, and the foundation of this art is the ability to work glass into the various forms that are required. The conversion of a piece of glass, which has perhaps been thrown into the ash box as useless, into an instrument which will increase our power of seeing things twenty or even fifty times, is a feat which any smart boy may accomplish. Such a magnifier or microscope will afford a great deal more pleasure than can be obtained from a far better instrument which has been purchased, and when the skill which has accomplished this simple undertaking has been so far improved that microscopes and telescopes of fair quality are the product of one's own labors, we feel that the result more than pays for all the labor and study that has been expended.

To most persons the construction of a microscope or a telescope seems to require wonderful skill and a very long course of training, but while this may be true in regard to the very highest departments, it is not true of ordinary optical work, very much of which is performed by boys and girls. It does not require any extraordinary mechanical genius or any very expensive tools to make a microscope which will show the most beautiful of the ordinarily invisible objects about which we hear so much. Neither does it require a long apprenticeship or very elaborate tools to enable an earnest lad to make a telescope which will show the moons of Jupiter, the moon-like phases of Venus, or even the rings of Saturn. The construction of a microscope or a telescope which will equal those turned out by famous makers will, of course, tax his utmost efforts, and probably be far beyond

his reach, but there is open to him a field wide enough and useful enough to employ many years, and yield results worth all the time and trouble required.

In the directions which follow we have drawn not only from our own experience, but from the writings of Brewster, Imison, Holtzapffel, Wenham, and others. Modern works on optics give no directions about the mechanical construction of the different instruments used, and the student who tries to pick up information from books will find very little upon the subject. The older writers gave directions which, for the day in which they were written, were very complete. We have now before us a very elaborate work—over two hundred years old—in which the grinding of lenses is very fully described and illustrated. In this book we find a description of a binocular microscope and directions for what in modern times is known as the *local polishing* of lenses—things which are supposed to be of very recent origin. Imison, in his "School of Arts," gives some directions for lens-making, and Brewster, in his edition of Ferguson's "Lectures on Mechanics," tells how to grind lenses and specula. The most complete treatise on the subject, however, is that of Holtzapffel, who, in the third volume of his "Mechanical Manipulation," gives a very full account of the grinding of glass for optical purposes, but the optical part of the subject he does not touch upon. The most precise directions for making objectives, prisms, etc., have been given by Mr. Wenham in the *Monthly Microscopical Journal.* Like all the writings of this gentleman they are thoroughly accurate, minute, and practical. They have recently been republished by Dr. Beale in his book, "How to Work With the Microscope," and we propose to embody almost the entire matter of these papers, with the illustrations, in the articles which we shall give to our readers. In the chapter given by Beale on this subject, there are a number of valuable suggestions and additions by Mr. Swift, the well-known microscope maker.

Mr. Ross, who contributed the famous article on the microscpe to the *Penny Cyclopædia,* also gave some instructions for preparing polishing powders*, for producing flat surfaces in glass, and for setting lenses. "Ree's Cyclopædia" also contains some practical matter scattered through different articles. Outside these works we know of nothing that is available to the young student.

We have thought it well to point out these sources of information so that our readers may have an idea of how little there is to be found on the subject. Ordinary books on chemical and physical manipulation (such as Faraday's and Williams' works on "Chemical Manipulation," and Frick's "Physical Technics") do not touch upon the subject of glass grinding at all.

One question which will probably occur to the minds of our readers we may as well answer here. It is this: How much optical knowledge must the student have in order to succeed?

Of course the more the better, but at the same time it must be acknowledged that but a very slight acquaintance with the laws of optics is necessary to enable one to make even a tolerably good objective, and to use it with good effect. The reader who will master the ordinary chapters on optics in our school philosophies will be able to follow out the practical parts of these articles to good advantage. Particularly should he study the course of light through ordinary lenses, and the way in which these lenses form images greater or less than the object which makes the image. He should become familiar with the forms and names of the different kinds of lenses, as plano-convex, double convex, meniscus, etc., and he should inform himself in regard to the elementary facts and laws which govern the decomposition of light by the prism. This much is easily learned, and may be found in any text-book on Natural Philosophy. Those who desire a popular and yet thoroughly accurate book on the subject, would do well to study that part of Deschanel's Philosophy that is devoted to

*The directions given by Mr. Andrew Ross, Lord Ross, Holtzapffel, and others, for preparing polishing powders, are published in full in the "Workshop Companion."

optics. Having gone thus far the reader will be able to guide himself, and the further he goes in this direction the better work will he be able to turn out.

To be able to make the lenses for a microscope or telescope we must have: First, a knowledge of the proper forms of the pieces of glass that are needed, and also of the qualities of the kinds of glass best suited to the different parts; and, secondly, the mechanical ability to work these different pieces of glass into proper shape. The second requisite is that which in practice makes itself felt first, and we shall, therefore, turn our attention at once to the materials and tools required.

GLASS.

Glass is the material out of which all lenses for purely optical purposes are now made. Chemists enumerate nine different kinds of glass, but of these two only, flint glass and crown glass, are generally employed by opticians. Speaking of the glass used in making the best modern objectives, Mr. Wenham gives us the following information, much of which will at present be beyond the understanding of the majority of our readers, but, as we desire to make these articles complete and furnish information which will be valuable to advanced students, we give it unabridged. He says:

"Under this head I can offer but very little information, for, in common with all other workers in this direction, I have merely made use of such various samples of glass as I have been able to procure. The whole secret of the ingredients used, their proportions and chemical constitution, is in the hands of the makers; and though the two or three of them who have paid attention to the manufacture have doubtless well studied the particular application of both the flint and the crown for the construction of microscopic lenses, yet the best that we can procure falls far short of the requirements of the case for the very highest powers.

"It is usual to denote the quality of flint glass by its density, but this in reality forms no accurate criterion of its dispersive power. Formerly, under this impression, I procured a quantity of dense flint, made by Chance, of Birmingham—very hard, white, and free from ability to tarnish, and to all appearances as good a quality of glass as I had seen. Its density was 3·867, but on trial I found it unfit for the construction of the highest powers, as its dispersive power was lower than the Swiss 3·686, or even the 3·630 that I had employed previously while its refraction was much greater. Some ingredient had been added which increased the refraction, and probably lessened the dispersion; and, of course, in a correcting concave, the latter quality alone is needed, and the lower the refraction the better.

"The crown and flint employed in the one-eighth described at the commencement of this essay,* of the respective densities of 2·437 and 3·686, had a relative dispersive power of 11 to 25; this having been very accurately determined by two prisms, whose angles were in this proportion, and which, when superposed, were perfectly achromatic. Faraday made some dense flint having a specific gravity as high as 6·4, but we have no information relating to its refractive and dispersive power.

"We are thus somewhat ignorant of the material elements of construction employed in the microscope object-glass; and it would be very desirable that a series of experiments should be made, with various combinations of all the known materials that can be used in glass-making, and the resulting compounds worked into equilateral prisms, and their refractive and dispersive powers tabulated, with the component ingredients. A few years back this investigation would have been a very troublesome and expensive one, by reason of the interference of the Excise laws, and the necessity of employing a regular glass furnace, to operate on large quantities at once, in order to lessen the effects of impurities. But now, by means of the recently invented gas furnaces, the greatest possible heat may be commanded, under perfect control, and thus enable the operator to combine materials in very small

*In a subsequent number we shall publish Mr. Wenham's directions, illustrated with cuts, for making this objective.

quantities without the intrusion of impurities from the fuel and furnace-lining, or crucible, which may be of platinum. The results of the investigation would unquestionably be valuable, and we might possibly be able to discover compounds which would neutralize the secondary spectrum. The late Thomas Cooke has repeatedly stated that if, while viewing a difficult double star through a telescope, some one was to sweep away the secondary spectrum, he would scarcely be able to discover any improvement, either in light or definition. But I am of opinion that the case is different with a microscope object-glass, wherein, with the highest powers, every trifling error is so enormously magnified, and in resolving the most difficult tests the effects of irrationality are at times very apparent."

Transferring Prints and Leaf-Forms to Wood.

TO transfer pictures to sycamore or white pine, you must first plane your wood perfectly smooth, and give a few coats of French polish; then take your picture, and damp it with a sponge soaked in spirits of wine; place the picture on the wood, and then place a piece of thickish cloth over the picture; then get a warm iron and rub gently over the cloth, being careful not to shift the picture. You must keep rubbing the iron backwards and forwards for ten or fifteen minutes, then take off your cloth and leave it for some hours. Then you must get some cold water and damp your finger in it and rub the paper. Great care must be taken in this, or you will disturb the impression. Keep damping your finger as you go on. When you have got it all off you can polish over. Any kind of picture will do with the exception of glazed ones. Ink pictures take off best. There is another method by which the effect of white leaves prettily grouped on a dark, softly graduated ground is produced. The leaf or pattern is fastened temporarily to the wood, which must, of course, be nice and smooth, fit for varnishing. Then take a brush of stiffish bristles filled with some pigment. Bend back the bristles towards you, and away from your pattern, then let go suddenly. Some of the pigment will then be precipitated on the wood where not covered by the pattern. You proceed in this way till your judgment tells you the pattern is well defined, taking care to vignette or allow the shadow thus produced to fade away towards the edges. You may advantageously practice with a blacking brush, using blacking thinned down with gum water for the pigment on a sheet of paper, using a fern leaf or two for patterns.

A Cipher.

THE word cipher has various meanings. It is usually applied to the figure 0, which is equivalent to zero or nothing. It also means a combination or intertexture of letters, as the initials of a name, the several letters being intertwined so as to form one figure. Such figures, or *monograms* as they are now generally called, were very generally used by painters and

MONOGRAM CONTAINING THE ENTIRE ALPHABET.

engravers, each of whom was known by his cipher.

The cipher or monogram in the accompanying engraving contains all the letters

of the alphabet, and will prove a study for some of our young readers.

The word *cipher* also means secret writing—the proper name for which, however, is *cryptogram*. During the war, dispatches were often sent in cipher, and politicians and lovers sometimes use cipher dispatches when they wish to keep their messages secret. The following example of a cipher will interest our readers. It was composed by Prof. Whewell at the request of a lady:

You 0 a 0, but I 0 thee,
O 0 no 0, but O 0 me,
O let then thy 0 my 0 be,
And give 0 0 I 0 thee.

Which being figured out means:

You sigh for a cipher, but I sigh for thee,
O, sigh for no cipher, but Oh, sigh for me,
O let then thy sigh for my cipher be,
And give sigh for sigh—for I sigh for thee.

Scroll-Sawing.—VI.

BY F. T. HODGSON.

THERE is no branch of scroll-sawing that will give pleasanter results or afford more amusement than the cutting of silhouettes. Sheets of designs for this purpose can be obtained at almost any book store for a very small sum. Many excellent designs can be found in illustrated papers and books for children, wall papers, and illustrated labels. A silhouette is simply an outline of some figure. and when cut with a fret saw, as a rule, has no inside cutting; Fig. 26 will give you a good idea of what constitutes a silhouette. They should form material not more than one-sixteenth thick. Hard rubber, ebony, black walnut, and rosewood on the one hand, and white holly, rock maple, and basswood on the other, are used for this work. Silhouettes may be employed for a thousand decorative purposes; and if you possess a good treadle machine you can find, if you desire, employment enough in this direction in making an infinite number of ornaments for your own and your friends' homes. Cornices for windows, doors and rooms can be made by this process, that will be highly ornamental if neatly and properly done, and taste and judgment employed in the selection of patterns. To form a cornice, say for a bedroom ceiling, paste a strip of dark colored paper all round the room close into the angle, and on the upright wall. The strip of paper should not be less than half an inch wide for every foot in height of the room; thus, if a room is ten feet high, the strip should not be less than five inches in width. It will stand to be wider, but will not admit of being narrower than as above. This strip forms a background for the whole work, and it may have a different colored

Fig. 26.

strip, or a gold bead, half an inch wide, running on its lower edge all round the room, or may be cut serated or wavy on the edge, as the taste of the workman may suggest. When this is done, cut your silhouettes according to pattern chosen, of maple or white holly, four or five at a time; when the number cut is sufficient to go round the room, they should be glued on to the strip of paper, being careful not to daub the latter all over with surplus glue. When this is finished satisfactorily, if desirable, a smaller pattern of walnut or ebony may be cut and glued on the white holly or maple, and this again

touched with gold leaf in the centre, or a small flower in colors might be painted on each piece. Making a cornice of this kind is a very simple matter, but when completed is sure to give pleasure to all who see it. The workman of tact will find suggestions crowding on him thick and fast as he proceeds with his work, and more elaborate cornices will be easy of design after the first one is completed.

Borders for panels, corner ornaments, and centre-pieces for door panels, pictures, cartoons and animals, can be cut out of veneers with very little practice. If you wish to saw out a perfect likeness of any one, in profile, stretch a piece of strong white paper over a frame prepared for the purpose, and about two feet square; let the subject sit between a strong light and the paper, and in such a position that the shadow in profile will fall directly on the latter, which must be held securely in its place. Now trace the outlines of the shadow on the paper with a soft lead pencil, on the dark side of the frame. If neatly done you will have an exact likeness in profile of your friend, which can be reduced, preserving the features correctly, by using a good pantograph. With a little practice in this line you will be astonished at the excellence of your own work. If you wish to make the likenesses distorted, and still have them preserve the general character of outline, you can do so by holding the paper at different angles, and by a little adjustment of the frame you will soon discover what position will insure the funniest results. Once having obtained a good likeness, you should keep it for a pattern, and you will not be long in finding use for all the duplicates you may make. If you are the happy possessor of a printing press you can find plenty of employment for your saw in cutting letters of every description for use in your press. Cut the letters from hard veneers and glue them on blocks of maple or beech, taking care that the type when completed are the exact thickness of other type. I have known a country printing office where all the display type for large bills and posters were made this way, and satisfaction was given every time they were used, and the saving in expense was considerable. Borders, corner ornaments, figures, and many other things for printer's use can be made with a good saw in skilful hands.

Although I have made no use of the word or words "overlaying," I have treated somewhat on the subject. It simply consists in cutting out fine ornaments and fastening them on a dead surface of some kind, such as panels, drawer fronts, box lids, album covers, etc., etc. Ordinary flat picture frames can be overlaid with vines or fine tracery. Very nice photograph frames can be made by taking a thin pine board and sawing an oval out of the centre, and covering the pine with velvet. Fasten the overlaying on the velvet. Designs for overlaying, such as corner ornaments, vines, flowers, heads, borders, monograms, fancy letters, and other pretty devices can be picked up in books, prints, and illustrated papers; or they can be bought from the regular dealers in scroll-sawing materials.

Looking Into Dark Places.

IT is often necessary to examine the bottom of a tube or hole. Wells and gun-barrels afford familiar examples. Nothing is easier provided we illuminate the cavity by means of a good light thrown down by a mirror. For wells, cisterns and ponds a good common hand-mirror will answer, but for narrow tubes, like gun-barrels, a little management is required. The mirror must be held so as to reflect a strong light (sunlight is best, but any good lamp will do) down the barrel, and at the same time it must be so placed that the eye can see past its edge and look down the tube. This can be done, but a great improvement is to scratch a small oval hole in the silvering, so as to leave the mirror transparent at this point. It then becomes easy to look down the barrel through this hole, while the silvered part of the mirror covers the whole of the tube and throws a flood of light down it. In this way rust spots and imperfections can be detected at the bottom of the smallest bores.

For wells and ponds no such refinement is necessary. When the sun is shining brightly, hold a mirror so that the re-

flected rays of light will fall into the water. A bright spot will be seen at the bottom, so light as to show the smallest object plainly. By this means we have examined the bottoms of wells fifty feet deep, when half full or more of water. The smallest straw or other objects can be perfectly seen from the surface. In the same way one can examine the bottom of the ponds and rivers, if the waters be somewhat clear and not agitated by winds or rapid motion. If a well or cistern be under cover, or shaded by a building so that the sunlight will not fall near the opening, it is only necessary to employ two mirrors, using one to reflect the light to the opening, and another to reflect it down into the water. Bright sunlight may be thrown fifty or a hundred yards to the precise spot desirable, and then downward. We have used the mirror with success to reflect light around the house to a shaded well, and also to carry it from a south window through two rooms, and then into a cistern under the north side of the house. Half a dozen reflections of light may be made, though each mirror diminishes the brilliancy of the light. Let any one not familiar with the method, try it, and he will not only find it useful, but a very pleasant experiment. It will, perhaps, reveal a mass of sediment at the bottom of a well that has been little thought of, but which may have been a frighlful source of disease by its decay in the water.

Drawing Lessons.—V.

BY JOHN CLARK CENTER.

WE will now turn our attention to exercises that will require a different method of treatment, and develop a quick and free use of the hand and pencil.

The examples of curved lines in Fig. 1 must be practiced, and the pupil must not rest satisfied until he is able with a single sweep to draw them correctly. He should attempt to draw these curves in all manner of positions, beginning at the top, then at the bottom, and making the curve upwards, and so on, until the utmost facility is attained in drawing them, however placed. The curved line, known as the

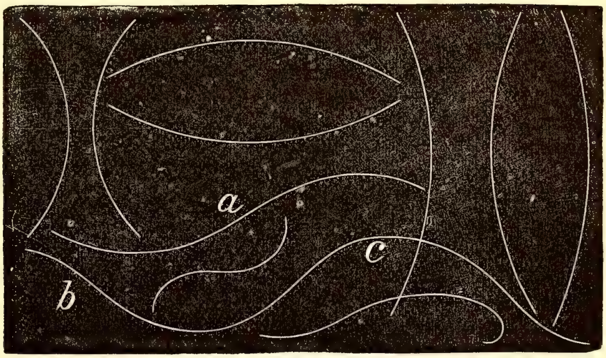


Fig. 1.

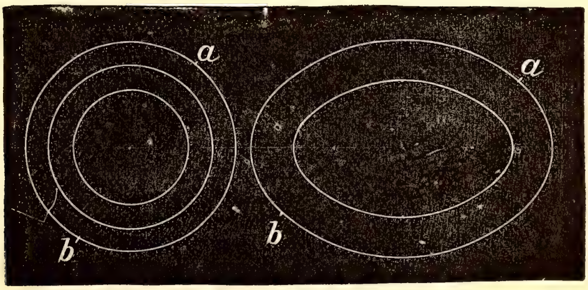


Fig. 2.

"line of beauty," *a b c*, must next be mastered; it is of the utmost importance to be able to do this easily and correctly.

Circles, and ellipses or ovals, must also be drawn independent of mechanical methods. In Fig. 2 the circle, beginning at *a*, sweeps round by the right to *b*, then from *b* towards the left and up to *a*, where first begun. The pupil may also try to draw it the reverse way. Circles within circles may be thus drawn, and ovals within ovals in the same manner. In sketching ancient or modern architectural edifices, the combination of straight and curved lines will be called for to describe the various orders of architecture, which can be either studied from nature or in works treating on that art.

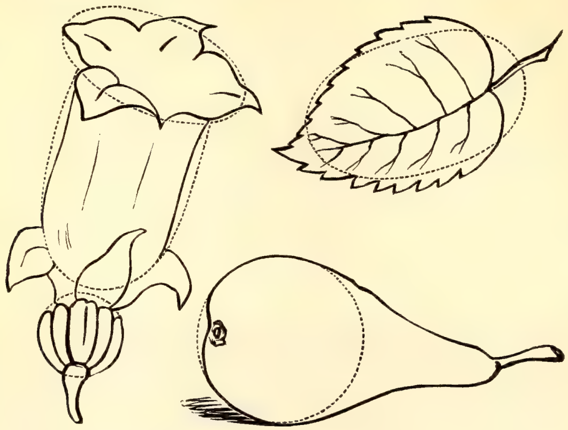


Fig. 3.

In Fig. 3, for the leaf a correct ellipse is first drawn. Thereafter the top *(a)* and the end *(b)*, rubbing out the parts not required, the fibres and serated edges are added and the leaf is finished.

The pear exemplifies the use of the arch, and the analytical sketch of the flower will illustrate how all varities of similar objects may be treated.

The pupil, in drawing figures and objects from nature, should provide himself with cartridge paper; this material has a rough surface, which takes the pencil easily and will bear rubbing out well. Also a few black lead pencils; some rather hard to make the outlines, and others soft for shading. Having selected a subject for study, a careful outline sketch must first be made. An old dilapidated building, stile, or pump, are favorite examples for practice, with the trunk and foliage of a tree.

Endeavor to produce the proper degree of shade at one operation, only having to retouch and strengthen by cross-strokes or greater depth, to produce effect or relief. In all well-executed engravings will be found examples of treatment of light and shade, and the pupil can easily and cheaply procure some of those drawing copies, which will facilitate progress in any department of drawing in which he may aspire to perfect himself.

We can only hope, in this brief but suggestive treatment on art, to inspire a taste for the useful and beautiful; perfection in any department can only be acquired by years of steady application and study.

Why Franklin Used Simple Language.

TRADITION has it that years ago, when Benjamin Franklin was a lad, he began to study philosophy, and soon became fond of applying technical terms to common objects. One evening, when he mentioned to his father that he had swallowed some acephalous mollusks, the old man was much alarmed, and suddenly seizing him called loudly for help. Mrs.

Franklin came with warm water, and the hired man rushed in with the garden pump. They forced half a gallon down his throat, then held him by the heels over the edge of the porch and shook him, while the old man said: "If we don't get them things out of Benny he will be pizened, sure." When they were out, and Benjamin explained that the articles alluded to were oysters, his father fondled him for an hour with a trunk strap for scaring the family. Tradition adds that ever afterward Franklin's language was marvelously simple and explicit.

Shadow Plays.

As a means of furnishing amusement to a small party of children (whether of large or small growth is a matter of no consequence), the old fashioned "shadow play," as it is called, can scarcely be excelled. It is so easily prepared, and requires so little experience or skill to work it, that we have often wondered that it is not more generally known.

Fig. 1.

The simplest form of shadow play, or shadow illusion, as it is sometimes called, is that known as "*The Witches Dance*," or "The Dance of Death," according as the figure which throws the shadow is that of an old witch with her broomstick, or a skeleton, and the play consists in throwing a number of these shadows upon a transparent screen, and causing them to move about in various grotesque ways. The shadows, however, are generally produced by one figure, which is cut out of pasteboard, and hung a short distance in front of the screen, as shown in Fig. 1. If our young readers will cut such a figure (of small size) out of card-board, and hang it before a wall, and then bring a candle or lamp behind it, of course a shadow will appear on the wall, and the closer the candle is to the figure the larger will be the shadow. If the candle be held at one side, the shadow will be made long and narrow; if above or below, the shadow will be short and dumpy. If the candle be moved with a quick jerk, the figure will appear to jump, and if the jerk be very quick and from a state of rest to a state of rest, the effect is more like magic than anything else. If the candle be moved slowly the figure moves slowly. If, however, there are more candles than one, the shadows will be multiplied—a shadow for each candle—and as some candles may be near the figure, and some at a distance, the shadows will be of different sizes and shapes. A little practice in the shape of rehearsals will soon give an insight into

the wonderful variety of effects that may be produced by the varying position of the candles.

The apparatus required is very simple and easily procured anywhere. First, we need a figure. This may be cut out of pasteboard, and the details should be worked out with considerable minuteness and accuracy if we would secure good results. The figure should be suspended behind the screen by several very fine silk threads, the shadows of which will not be seen.

The screen may be simply a sheet suspended between the doors of a double room, or in a hallway. Where this is inconvenient a corner of a large room might be screened off. The sheet should be thin, and to render it more transparent it should be sponged or sprinkled with water.

The lights are simply good paraffine candles. These are safer and more cleanly than hand-lamps, but the latter may be used if necessary. When candles are used, a paper cone should be fastened around them, about one or two inches from the top, so as to prevent the spilling of grease. If very strong lights are desired, four candles may be fixed closely together in a frame. They give darker shadows, but the shadows are not as sharply defined, as we cannot get the candles so close together that each one will not throw a separate shadow, which will overlap its neighbor, and produce a little indistinctness on the edges.

Our engravings show the manner of carrying out what we have described. Fig. 1 shows the operators behind the screens, and Fig. 2 the shadows as they appear to the audience.

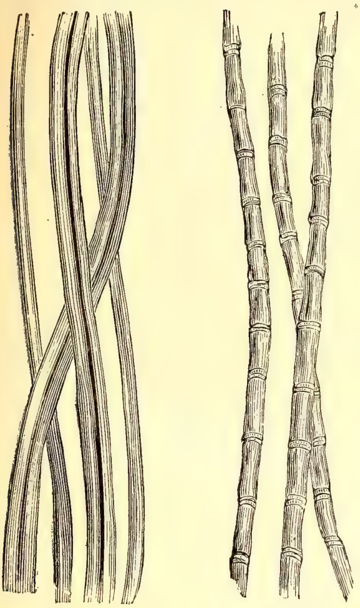
Fig. 2.

—No wonder the country swarms with preachers, physicians, lawyers, and literary mountebanks. There are seven times more nurseries for the propagation of literary pigmies who are taught to feed on the public, than there are to raise and train skillful mechanics, engineers, agriculturists and miners. Five hundred and seventy-nine colleges, universities, law, medical and theological schools, and only eighty-three schools for the higher mechanical and scientific education, including all schools of design, mining and engineering. There are twice as many theological schools as there are of engineering, scientific and mechanical schools, all told. No wonder that many trained preachers in this country go hungry to bed, while thousands of enterprising mechanics and artisans are floundering about in a sea of ignorance in search of higher "scientific attainments."

Notes on My Cabinet—Silk and Flax.

IN a former article I showed my young readers the difference between cotton and wool; I now give figures of flax and silk, which show very clearly the characteristics of these fibres. It will be seen that while silk is a smooth, even fibre, like a wire, or like spun glass, flax is irregular and knotted like a bamboo cane.

In examining dry goods, for the purpose of finding out what they are made of, it is



SILK. FLAX.

well to bear in mind the following facts in regard to the origin of these different fibres. Wool is an animal hair, covered with scales, which give it its *imbricated* appearance. It is round, solid and even, and under the microscope the prominent feature is the scales. Cotton is a vegetable hair which, when growing, formed a tube filled with liquid. When the hair dried the sides of the tube came together so as to form a flat ribbon.

Flax is the tissue of the stem of the plant. Instead of being smooth, like cotton, it is hard and solid, and as each fibre has been torn apart from its fellows, it is rough when contrasted with cotton or silk. Many attempts have been made to break the flax up into fibres so fine that they could take the place of cotton. Often and often we have been shown "flax-cotton," as it was called, which the inventors thought could not be distinguished from real cotton. Under the microscope the difference was at once visible, and when worked in the ordinary cotton machinery it showed its character very plainly.

Silk is a fine fibre spun by the silk worm as a covering (cocoon) to protect itself while in a dormant state. The silk fibre is really a solidified liquid. The worm draws the viscid, tough liquid out of its spinnerets, and the fine thread thus produced hardens when it comes in contact with the air. Silk, therefore, has no *structure*, as it is called—that is to say, it is not composed of cells like flax or wool, but is the same throughout just like wire or spun glass. The *gut* used by fishermen is the same thing, but thicker fibres. Instead of being spun by the worm, however, it is spun by men who kill the worm, expose the bag of liquid, and draw it out so as to form a thread of the desired length and thickness. Gut is, therefore, merely a stout thread artificially produced from the same substance that is used by the silk worm to produce silk.

O. W.

A Cheap and Simple Camera for the Microscope.

THE following capital little device is described by Mr. T. B. Jennings, in the *American Journal of Microscopy*, and we republish it from advance sheets of that journal:

Probably there is nothing that will assist the student in microscopy so thoroughly as drawing the object, as he thereby *fixes* the different parts in his mind.

A good camera lucida is too expensive for many persons, while other and more necessary accessories are being purchased.

Having made a good reflector for my own use at *no* expense, and thinking that many of your subscribers might desire to do the same, I give the mode.

Take a flat cork, Fig 1, *a* (mine was from a large-mouthed bottle), cut a hole, *b*, through its centre large enough to fit over the eye-piece after the cap has been

removed. Just below the hole make an incision, *c*, so that it will hold a thin glass cover, *d*, at an angle of 45°. I use a cover ¾ of an inch in diameter.

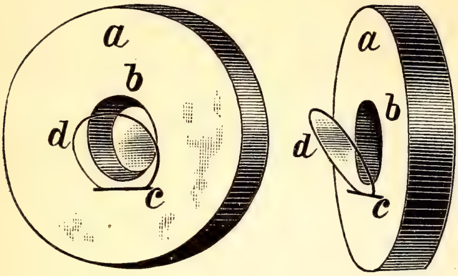


Fig. 1. Fig. 2.
CHEAP CAMERA LUCIDA.

The "reflector" can be easily removed when not in use, and the glass readily taken out to be cleaned. Fig. 2 is a side view.

Editorial Notes.

The Young Scientist for 1880.

IN commencing a new year it may not be out of place to give our readers a few hints in regard to the articles we have in store for them. In addition to the series which have already been commenced, such as Mr. Hodgson's articles on Scroll Sawing, the articles on the Battery, on Home-made Telescopes and Microscopes, Magic, Drawing, etc., we have a series on the Turning Lathe, by Mr. Harrison (author of a well-known work on small tools); another on Home-made Magic Lanterns, one on Amateur Silk Culture, etc. Considerable attention will be given to Amateur Microscopy.

The articles by Mr. Wright, on Astronomy, will be continued during the year, and he has promised us a series of Notes on the Moon. These cannot fail to prove deeply interesting, especially to beginners in astronomy. With the March number we will send out a fine Map of the Moon, twelve inches in diameter, reproduced from Beer & Maedler's "Mappa Selenographica." This will illustrate Prof. Wright's articles, and to those interested in astronomy will be worth more than the price of the YOUNG SCIENTIST for one year.

We ask our readers to do all they can to increase our circulation and help forward the good work. Remember that the YOUNG SCIENTIST is the only journal of the kind in the world. Several very earnest attempts have been made to start journals of a similar character, but they have all, without exception, failed. The YOUNG SCIENTIST is the only one that survives. Story papers have sprung up by the dozen, and they flourish amazingly, and some of those recently started make a great flourish of trumpets about occupying the field we have taken up. It still remains a fact, however, that the YOUNG SCIENTIST is the only journal which is strictly devoted to experimental science and amateur arts.

We do not ask any one to help us without an equivalent, but if you think that the YOUNG SCIENTIST deserves support, send in your own subscription and get up a club amongst your friends.

To Our Subscribers.

WE send this number to all whose names are on our books—whether paid or unpaid. As the subscription to the YOUNG SCIENTIST is too small to allow us to incur the expense of postage and letter-writing for the collection of old accounts, the journal cannot be sent after this date to those who have not renewed their sub-subscriptions.

Designs for Scroll-Sawyers.

MR. HODGSON, whose admirable articles on scroll-sawing are now in course of publication in the YOUNG SCIENTIST, has prepared for us a series of seventeen designs covering a great variety of. subjects suitable for Christmas presents and ordinary articles of household ornament and utility. These designs we have had photo-lithographed and printed on two large sheets. They are full size and embrace over eighty different pieces. Knowing that this set must have a large sale, we have placed the price at 25 cents for the set, or a cent and a half for each design. We know of no designs equal to these which can be had for less than five, ten, or twenty cents each.

To any boy or girl who will send us a new subscriber, (together with their own

subscription) we will send a set of these designs free. The subscriptions may be for 1878, 1879, or 1880. Remember, one of the subscribers must be new. It will not do to send a renewal of the subscriptions of two old subscribers.

BOOK NOTICES.

Some Practical Hints on Wood-Engraving, for the Instruction of Reviewers and the Public. By J. W. Linton. Price $1.25. Boston: Lee & Shepard.

Some time ago Mr. Linton published an article in the *Atlantic Monthly* on "Wood-Engraving," and the present volume is a reply to the criticisms which that article called forth. In his first article, Mr. Linton criticised severely, and we think with justice, certain new departures in wood engraving, which have recently appeared in some of our prominent magazines. As distinguished from the older styles, these new methods are characterized by a certain nebulousness which the authors seem to mistake for softness or something else, but which gives us simply the impression that the photographer who transferred the original drawing to the material on which it is cut, did not take the requisite pains to get his picture sharply in focus. It is, consequently, indistinct, as well as flat and inexpressive. Those who go into extacies over the new style seem to be led astray by the idea that because in some paintings the outlines are indistinct and yet wonderfully suggestive, therefore this quality may be transferred to a wood cut simply by blurring the outlines. No greater mistake can be made. Every painting and every engraving is valuable for two things—what it tells and what it suggests, and the latter is often as valuable as the former. And it often happens too that the most suggestive part of a picture is not that which is most sharply outlined. Indeed, the reverse is more often the case, and yet, as we have already remarked, suggestiveness cannot be imparted by indistinctness alone,

Aside from the mere controversy, the book contains much information that will be of value to all who are interested in the art of wood engraving. As regards the merits of the fight, Mr. Linton certainly has greatly the advantage of his adversaries in accuracy of knowledge and clearness of perception.

The Builder and Wood Worker. A Journal for Architects, Cabinet Makers, Stair Builders, Carpenters, Car Builders, etc. Monthly. $1.50 per year. Chas. D. Lakey, 176 Broadway, New York.

The *American Builder* has now been consolidated with the *Wood Worker*, and under the able editorial management of Mr. Hodgson, whose contributions to the YOUNG SCIENTIST have always been so welcome, the combined journals present a most attractive appearance, as well as a table of contents, which render them worth many times their cost to those who are interested in the subjects of which they treat. The *Wood Worker* had already attained a high degree of success, and the *Builder* is well known as one of the oldest journals in this department of the industrial arts. Every one interested in building and wood working should subscribe for this journal.

Astronomy for Amateurs.

BY BERLIN H. WRIGHT.

February, 1880.

EPHEMERIDES OF THE PLANETS.

(Calculated for the Latitude of New York City.)

	D.	*H.*	*M.*	
Venus rises	10	4	56	morning
" "	29	5	6	"
Mars in Meridian	10	6	21	evening
" "	20	6	1	"
" "	29	5	45	"
Jupiter sets	10	7	34	"
" "	20	7	7	"
" "	29	6	42	"
Saturn "	10	9	36	"
" "	20	9	1	"
" "	29	8	31	"
Uranus in Meridian	10	1	20	morning
" "	29	11	58	evening
Neptune sets	29	10	41	"

NEAR APPROACH OF MOON TO STARS AND PLANETS, ETC.

Day.

1. Moon 4° North of Spica.
5. " 2° " Antares.
7. " 1¾° South of Venus.
7. " 5° North of "Milk Maid's Dipper."
12. " 6¼° " Jupiter.
14. " 8° " Saturn.
14. Mercury superior conjunction with Sun.
17. Moon in Pleiades.
18. " 1½° North of Mars.
18. " 10° " Aldebaran.
19. " 18° " Betelguese.
22. Moon midway between Procyon and Pollux.
23. Mars 90° East of the Sun.
24. Moon near Regulus.
25. Uranus 180° from Sun. (*Brightest.*)
28. Moon 5° North of Spica.

EASY TELESCOPIC OBJECTS.

Uranus may be seen with any ordinary telescope, but it requires an aperture of 4 inches or more to give sufficient light to define a disc, which only subtends an angle of 4″, and the best telescopes only show a dull bluish disc. Place, Feb. 10, R. A. 10h. 38m. 33s. Dec. 9, 9° 27′ 29″ +.

Orion is favorably situated for observation, not having an uncomfortable altitude, and being on the meridian at 8 o'clock in the evening in the early part of February. This is con-

sidered to be the grandest of the constellations, and the observer will be well repaid for careful observation. It has fewer Nebular objects than Ursa Major, but grander, and it contains such a vast number of bright and double stars, and clusters, that it affords a far richer field for the astronomical observer. It contains two stars of the 1st mag., four of the 2nd, and three of the 3d. The great nebula and the trapezium have already been described and figured in the YOUNG SCIENTIST for March, 1879, p. 46.

Betelguese is the most brilliant star, being, when brightest (it is an irregular variable), the "largest star in the northern hemisphere." Lasell says of it: "A rich topaz, in hue and brilliancy differing from anything I have ever seen." It is double; companion 9th mag., 160″ distant. A line from Betelguese through the belt, continued nearly as far again, will reach Rigel, a double, and the brightest star below the belt, and one which will severely test the observer's telescope, if small. The companion is of the 9th mag. and distant 9′.5; its combined closeness and smallness render it difficult, but it has been separated with an aperture as low as 2¾ inches—we have seen it with a 3-inch achromatic—companion, blue.

Very close to the lowermost star in the belt (½° west, and a trifle lower) is a bright white star of the 4th mag. This is a fine multiple star—a double triplet, with two fine stars between the sets, and easily found. Fifteen stars have been counted in this group—eight with a good 3-inch glass. This is a most interesting object, even when very small telescopes are used, and it also forms a good test-object for distinction. Color of companions: bright white, ash-colored, bluish, grape-red, dusky, white, and pale-grey.

We have not yet told the half of the richness of this constellation, but must close.

Jupiter is too near the sun to admit of satisfactory observation of the phenomena of his satellites.

Penn Yan, N. Y.

Finishing and Polishing Brass.

Many who hear the words "brass finisher" may be led to believe that this would apply to those who produce highly-finished work; but it is not so, the brass finishers in reality are not the superior class of workmen supposed, the work most of them do is comprised in gas-fittings, ormolu mounts, etc.; but the high class of brass finishing is a totally different process. We will take several examples: First, say fittings for gas work, all well-enough finished for their several purposes, and quite as well done as the price paid for them will allow. Then we come to the mountings for furniture; these must obviously be produced at a low price, in order to supply the demand for cheap things of this character. We will now pass on to a totally different class of work—for instance, microscopic and philosophical instruments. These are most beautifully finished, and must also be made in a superior manner, before any attempt can be made to finish them; also the beautiful parts that are now made to the turning lathes of the present day. As this particular branch affords scope for the explanation of really good brass finishing, we will take a few parts of the lathe and its various appurtenances. In making an eccentric chuck, a deal of high-class work will be required. We cannot call a piece of work well finished that is simply very bright, but full of scratches. High polish and deep scratch must at all risks be avoided, as the latter are a sign of indifference on the part of the workmen. To begin, or rather before commencing to finish and polish, all marks of the file must be removed, and this is done thus: Having used a superfine Lancashire file to draw the edges and file the surfaces, take a piece of moderately fine emery paper and wrap it tightly round the file, only once round. It is by having so many folds round the file that the work becomes rounded off at the edges, and made to look like second-hand things that have been cleaned up several times. Some workmen use emery sticks; they are made by having several pieces of wood planed up, about ⅜ inch thick and ¾ inch wide, quite flat on the surfaces. This done, they are covered with a solution of thin glue, and the emery powdered on to them, and then allowed to dry hard. Most of the common work is, I will not say finished, but rubbed over with emery cloth. This is all well and good for such purposes, but it will not do for good work. Having folded the paper once round the file, it is worked in a similar manner to the file, and when the file marks disappear, and the paper is well worn, a little oil should be used with it, as this fills up the paper and makes it cut smoother. Having got up the edges and surfaces to this extent, to finish the edges must be the first thing, and the best way to effect this is to have a piece of soft wood, quite flat, and rub on its surface a little oilstone powder, free from grit. Now, the best way to be sure of having it quite clean is to have a piece of old Turkey-stone by you, and as you want to use it break a small piece off and pound it on the corner of a surface, or anything equally hard. You will then be sure that it is quite clean. It is exceedingly annoying to make a deep mark in the work just as it is finished, perhaps a mark that will require

filing out. However, it is better to avoid doing it than to have to eradicate it after it is done.

When the work has been well finished with the stick and oilstone powder, a clean buff, with a little rottenstone and oil, and then dry rottenstone should be used, and, if properly done, a most beautiful, bright, clean, and flat finish is obtained. Having finished the edges thus, to do the surfaces will be the next part. They, also, must have all the marks of the file taken out, and be got quite smooth from the paper. This done, if it is to be curled, which is the best and most ornamental way of finishing such work nowadays, a piece of water-of-ayr stone, used with water, will remove such scratches as may be left from the emery-paper; also, it produces a kind of cloud, previous to using the charcoal, which is the next process. Take a piece of cutting charcoal, which, by the way, there is some difficulty in obtaining, and it can only be got by going to some coal shed which, as a rule, is not of the most inviting; but if a thing is really wanted it must be obtained, even at the risk of having to attend one of these disagreeable habitations; and as I am telling our readers of the means of getting what they require, I may as well tell where the place is. In Crown Court, I think it is, in Newport Market, this material is to be found, and as there are several kinds, it is better to take a piece of brass and try it before purchasing, as some will cut, some will not, and out of fifty pieces perhaps only two or three will be of any use. Now having, we will assume, procured the material, unless it is properly used we may as well be without it. Before trying, file one end flat, and having a small basin of water by your side, dip the charcoal into it, and by curling it round and round in all directions the clouded surface is formed. Now, it must not be thought that by simply doing this that a good result will be obtained, for it is, in reality, a difficult thing to do, and unless well done it looks very inferior, and would be better left alone. When the surface is finished with this process, the next thing to be used is a piece of slate pencil brought to a point. This is also used with water, to make it cut, and is made to produce a series of small circles or rings, which must not be done with any regularity, but indiscriminately in all directions. There is great knack in all these different styles of finishing work, and there are not two men that do this particular branch in the same manner. This done, the next thing will be to lacquer it. This is similar to varnishing wood, the difference being that the metal must be made hot. I do not mean red hot, but after it has been well wiped over and brushed out with whiting, to take all the grease out, it should be put on a piece of red hot iron, and remain there till it is so hot that your finger would be quickly withdrawn if placed upon it. When it is taken off the iron, well wipe it again with a clean, dry rag, because where there is any grease the lacquer will not take, and on those parts it will show a dirty discolored mark in a short time. Always lacquer the edges of your work first. In using the brush a very light hand is necessary, and no more lacquer let in the brush than you can help. Above all things, both lacquer, brush, pot, and work must be free from dirt and dust. By following out these directions the superior finish seen on the best work may be obtained, and after all there is really little difficulty in it; care is one of the most essential points, and without that good work of any kind cannot be done.—*Forge and Lathe.*

Good Joints.

Our young friends who exercise their ingenuity in the construction of useful articles, and especially in making repairs about the homestead should give particular attention to the formation of the joints by which the different parts are united. One of the highest authorities, the late Professor Rankine sums up the principles which should be adhered to in designing joints and fastenings in carpentry, concisely as follows: First, to cut the joints and arrange the fastenings so as to weaken the pieces of timber they connect as little as possible. Second, to place each abutting surface in joint as nearly as possible perpendicular to the pressure which it has to transmit. Third, to proportion the area of each surface to the pressure which it has to bear, so that the timber may be safe against injury under the heaviest load that occurs in practice; and to form and fit every pair of such surfaces accurately, in order to distribute the stress uniformly. Four, to proportion the fastenings so that they may be of equal strength with the pieces which they connect. Five, to place the fastenings in each piece of timber so that there shall be sufficient resistance to the giving way of the joint by the fastenings shearing or crushing their way through the timber.

Practical Hints.

Liquid India Ink.—When India ink is kept in a liquid state it soon becomes worthless, from the fact that the gelatine which it contains decomposes. A little glycerine added acts as a preservative, and causes the ink to flow well. Too much glycerine will prevent the ink from drying, and in this case it is, of course, easily blotched or smeared.

Ink for Copying Pads.—An ink which will yield a hundred or more copies from a gelatin pad may be made by dissolving rosaniline in a cold saturated solution of oxalic acid. It must be allowed to dry spontaneously.

To Polish Steel.—Mix half a pound of fine flour of emery powder with the same quantity of soft soap, and add a small piece of soda. Simmer this over a slow fire for two hours, to extract all the moisture. Rub on with flannel, and finish with plenty of dry whiting.

Fastening Knives in Handles.—A writer in the *English Mechanic* tells us that knives with tangs should be put into a handle with powdered alum, the tang made hot as for resin. Let the handle be wood, iron, ivory, bone, or horn, it will be immovably fixed unless the handle is split, and far more cleanly than resin.

Silver Solder.—Writing to the *English Mechanic,* T. Fletcher condemns the addition of brass to this alloy, and says: "The only satisfactory silver solder I have ever used is 11 parts fine silver and 13 parts copper. If brass is used, the solder burns with a blow pipe flame, and runs badly, making very poor and unsatisfactory work. The alloy given above is as tough as charcoal iron, and is always to be trusted. It never burns, and is as fluid as water when melted.

NOTES AND QUERIES.

Queries.

42. In a journal recently started, and which makes great pretensions to scientific accuracy, the *American* inch is given as 39.381 metre. I always supposed that the American inch was the same as the English inch. How is it? METER.

43. I bought a bottle of "silvering fluid" which, when applied to brass stair rods, gives them a very bright, silvery appearance, but after a time they become dull. What can I do to keep them bright? BRASS.

44. I have a fine oil painting which has been varnished and spoilt. How can I remove the varnish without spoiling the painting? AMATEUR.

Answers.

45. METER (42). The British and the American inch are the same, and according to the latest determinations the ratio of the inch to the metre is: Metre=39.37043 inches. Some years ago a statement was made that the American foot was not the same as the English foot, and this error has crept into several scientific books. It has been frequently contradicted, but occasionally it appears again. Another origin for this singular error is the fact that some years ago Congress passed an act legalizing the metre, and in that act it was stated that the metre should be taken as 39.38 inches. It is very evident, however, that this act, so far as it went, legalized an American *metre,* not an American inch. At the same time we believe that the acknowledged metric standard is a copy of the French metre, and this being the case, we have an anomalous condition of things, there being actually two standards in this country.

45. BRASS (43). Your "silvering fluid" is probably a solution of mercury in nitric acid. It does not leave a coating of silver, but of mercury, and this will tarnish in spite of all you can do. If you use a silvering fluid containing pure silver, and then varnish the articles with a very pale varnish, they will remain bright a long time.

EXCHANGES.

Thos. D. Adams, Franklin, Pa., will exchange a $25 lawn mower, $60 coffee roaster, type, cards and books, $60; poultry journals, $10; 2 cocker spaniels, $30; 1 pair do., $80, and 1 pair $60; for key check outfit, improved model press, or offers.

To exchange, 270 foreign stamps, many new and all different, and a boy's printing press, size, inside chase, 3x4¾ inches, worth $9, for books, microscope, or offers. Henry J. Bott, La Fargeville, Jefferson Co., N. Y.

Wanted, a printing press and type; state what is wanted in exchange; "Official" preferred. A. Campbell. Derrick City, McKean Co., Pa.

Dumb bells of all sizes, to exchange for most any thing; send for circular containing weights of them to J. P. Donohue, Box 7, Davenport, Iowa.

A Lozo-pendulum board (lined with genuine billiard cloth), consisting of ring toss, bagatelle, pockets, and ten pin, to exchange for parlor magic, aboriginal relics, or offers. T. C. Gard, Frankfort, Indiana.

Wanted, scientific books and papers, microscope, drawing instruments, telephone, stamps and coins, in exchange for scroll saw, type, cards, revolver, shot gun, magazines, scientific books, or almost anything. W. L. Goodsell, Bath, N. Y.

A pair of New York Club skates, worth $3.50, also coins, minerals and postage stamps, for books or offers; correspondence invited. E. F. Greene, P. O. Box 889, Bath, Steuben Co., N. Y.

A nice marine oil painting, ready framed, worth $5.00; state what is offered in exchange. C. Hammond, Artist, P. O. Box 47, Chatham, Barnstable Co., Mass.

Photographic camera, one portrait and one landscape tube, with chemicals complete, in exchange for medical books. J. Frederick Herbert, 1,324 Poplar St., Philadelphia, Penn.

What offers for 1 Household Microscope, one 8 shot breech-loading carbine, 1 new 7 shot pistol and cartridges, 1 small gold watch, 1 small gold chain, 1 violin and case, one new darning machine. Lock Box 147, Tarboro, Edgecombe Co., N. C.

Back Nos. "Penman's Art Journal" for 1879; Gaskell's Compendium, $1; Coe & Shells' Pen and Ink Drawing, 25c.; Pettengill's Fortune Teller, 40c.; Hand-Book of Business, 25c.; in exchange for microscope, printing press, or offers. M. B. Moore, Morgan Station, Ky.

Trump's and Russel's scroll patterns, worth $10; for large lenses preferred. H. J. Peters, Rogersville, Ohio.

Lessons in Standard Phonography given in exchange for a printing press, lathe, scroll saw, scientific books, hammock, or offers. Phonographer, Box 331, Topeka, Kans.

Wanted, chemical apparatus, in exchange for "Phrenological Journal," $2, and the last six numbers of "American Agriculturist," 75 cents, of 1879. T. P. Potts, Canonsburg, Pa.

Land and fresh water shells, birds eggs, minerals, fossils (correctly named) or books, Gray's "How Plants Grow," Pope's "Linear Perspective Drawing," in exchange for a Multum in Parvo Collecting Box (for eggs). H. Russell, Grassy Cove, Cumberland Co., Tenn.

To exchange cocoons of the Atticus Cecropia for those of other rare moths, coins, stamps, trilobites, etc. Harry L. Shively, 680 N. Delaware St., Indianapolis, Ind.

To exchange for offers, good second-hand set of brass band instruments: 2 E-flat cornets, 2 B-flat cornets, 3 E-flat altos, 2 B-flat tenors, 1 B-flat bass, 1 E-flat tuba. David P. Thomas, Bellmore, Ind.

To exchange, a book, "Linear Perspective," perfectly new, also several other books; state offers. S. B. Wilson, Lenoir, Caldwell Co., N. C.

For exchange, magic lantern, 4 in. condenser, 28 slides, with gas bags and burner, also lamp; for printing press, gun, or anything. E. F. Youngs, Penn Yann, N. Y.

THE Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

VOL. III. NEW YORK, FEBRUARY, 1880. No. 2.

Scroll-Sawing.—VII.

BY F. T. HODGSON.

THE young sawyer will find no difficulty in obtaining designs or full-sized patterns for nearly everything that can be made with a fret-saw, at a very trifling cost. There may be cases, however, where designs cannot be procured for particular purposes. When this occurs, the workman will have to exercise his own ingenuity in devising some pattern to suit the emergency. In designing, it is always better to first make a drawing on coarse paper, in lead pencil, of half the pattern, then fold the paper double, and cut through both thicknesses with a knife or scissors, following the pencil lines closely. When finished cutting the paper, unfold, and you will see if the design meets with your expectations; if it does not, cut the one-half to suit, or paste on pieces of paper and cut again wherever necessary, and re-cut. By adopting this method you will soon be able to make handsome designs for any purpose.

The simplest way of applying patterns to the work is to paste the design right on the wood to be sawed, but care should be taken to put the paste on the parts of the pattern that will fall out after cutting; in this way you do not disfigure the part you wish to use. Where the work is to be French polished, it is better to do the polishing before the sawing is done, as a good piece of polishing can not be done afterwards. Oiling or varnishing may be done after the work is cut and put together, but in most cases it is as well to do the oiling or varnishing before the saw touches it.

It requires some little judgment in the selection of woods adapted to the different purposes for which they may be employed. If the work is fine, and full of delicate stems or vinery, avoid knots and select straight-grained, tough wood, and, before sawing, see that it is smooth and ready to receive oil, varnish, etc., as it is difficult to

smooth after being sawed. Most of the woods can be bought ready for the saw; if they are not smooth enough give them a good sandpapering with the finest grade of sandpaper. All kinds of wood will warp or curl more or less if the conditions are favorable, but when this happens the warp or curl can be taken out by damping the floor or a board of sufficient size, and laying the hollow side of the warped stuff on it, and in a short time the warp will disappear. Another method is to dampen the hollow side with steam, then hold the opposite side to the fire until straight. The best woods for the beginner to use are pine, Spanish and red cedar, butternut, poplar, white-wood, bass-wood, and black walnut. The advanced amateur can use to advantage, white holly, mahogany, amaranth, ebony, tulip, rosewood, maple, cocobola, and satin wood. Besides the woods mentioned above, there are many other substances employed in fret-sawing, such as hard rubber, tortoise-shell, ivory, pearl, brass, silver, and gold. The prices of the woods mentioned above, in New York, range as follows per square foot, when one-quarter of an inch in thickness: Pine, 5cts.; white-wood, 5cts.; Spanish cedar, 12cts.; bass-wood, 6cts.; poplar, 5cts.; black walnut, 8cts.; white holly, 16cts; mahogany, 14cts.; amaranth, 25cts.; ebony, 50cts.; tulip, 40cts.; rosewood, 20cts.; maple, 14cts.; cocobola, 25cts.; satin wood, 35cts.

There are also other woods than these that are made use of by the fret-sawyer, but they are scarce and costly, and I think the above-named will furnish a sufficient variety to fill the wants of most amateurs.

Home-Made Telescopes and Microscopes.—II.

FLINT and crown glass for optical purposes are articles of commerce, and are sold by the dealers in optical goods in discs of all sizes and thicknesses. Ordinary sizes are sold by the pound, and as there is a tolerable uniformity in the qualities of the two kinds, as made by any one house, the young optician may safely make his curves to conform to those published, satisfied that he will get very nearly the desired results. It may be interesting to our readers to know that the optical glass of most of the great houses of Europe may be had in New York. Messrs. Chance & Co. have an agency in Duane St., and Mr. Emmerich, of Maiden Lane, keeps on hand a stock of French and German glass. In their first trials, however, our readers will probably use such kinds of glass as they can find, for although it does not require a long apprenticeship to enable the young workman to turn out fair lenses, he must not expect to be able to do it without *some* pratice. Therefore, it will be well to begin on simple magnifiers of medium size and power, and gradually pass to more complicated arrangements requiring greater skill and experience. The making of such lenses is by no means a waste of time, for besides the skill which is obtained, the lenses themselves are always useful for magnifiers, and when mounted in simple handles, as hereafter described, they are useful for dissecting microscopes, and make nice presents to such of our friends as have a taste for botany, entomology, etc.

Such magnifiers may be very well made out of such pieces of common glass as are procurable almost anywhere. It is well, therefore, for the young optician to inform himself in regard to the different kinds of glass in ordinary use.

All glass used for optical purposes must be free from striæ and air bubbles. It is very evident that an air bubble would unfit a piece of glass for making a lens or a prism, and a streak of lighter or heavier glass running through a piece is equally bad, as it produces the same effect that is seen when we look through the heated air rising from a hot stove—objects seen through it are distorted. Glass which is free from striæ or streaks is said to be *homogeneous*, and it is this quality which it is so very difficult to secure in large masses, and which consequently limits the size of the object glasses of telescopes.

In examining a piece of glass for striæ we must be careful not to condemn it on account of wavy irregularities on the surface. These are all removed in working the glass, and do no harm.

The streaks and bubbles which are

always found in bottle glass and common window glass, render them useless for optical purposes. We must, therefore, have recourse to plate glass, which is a kind of crown glass, and flint glass. Pieces of plate glass may be found everywhere, and often of excellent quality, and with very well polished surfaces. Pieces of *old* plate glass are generally so scratched that the surfaces are useless until re-ground and polished, but if a good piece of new glass plate can be had, very excellent plano-convex magnifiers may be made out of it by grinding and polishing the convex side of the lens. For all ordinary lenses good plate glass is the best material, excepting, of course, the regular optical glass. It should be chosen of as light a color as possible, and any pieces in which streaks can be detected should be at once rejected. Sir David Brewster recommends, for non-achromatic lenses, glass of a straw color, whose dispersive power is as small as possible. The color of a piece of glass is of course best seen by looking through it edgewise.

Flint glass of fair quality may be found in many articles of every-day use. Tumblers and goblets of the better class are made of flint glass, and we know a very fair achromatic telescope, the objective of which was partly made out of a large flint glass tumbler. Most articles of cut glass are made out of flint, because this material is more easily worked, and it is also more brilliant, owing to its greater refracting power. Of two lenses of precisely the same curvature, one made of flint glass and the other out of crown glass, the flint glass would have the shortest focus and would magnify most.

Very excellent pieces of flint glass, but of small size, are sometimes found in the pendants of chandeliers.

TOOLS REQUIRED.

The tools required for mere glass grinding are few and simple. Large lenses, such as are used for telescopes, may be ground by hand, but small ones are always ground in turning lathes. For this purpose a very simple and cheap tool will answer—even those cheap lathes which are sold for from five to ten dollars. We have known very good lenses ground and polished by means of a lathe which had been worked up out of some old materials and fitted together with chisels and files. But for setting the lenses so as to produce an objective that will be better than a mere triplet, a really good lathe is necessary. A tolerable lathe is also necessary for turning up the brass tools used for grinding and polishing the glass, and as these tools must be very true, time is saved and a better result obtained by the use of a good lathe. Those who possess a well-made lathe will find no difficulty in making all the tools that are necessary—even those small lathes which are best adapted to the making of very minute lenses. Mr. Wenham describes that used by him as follows:

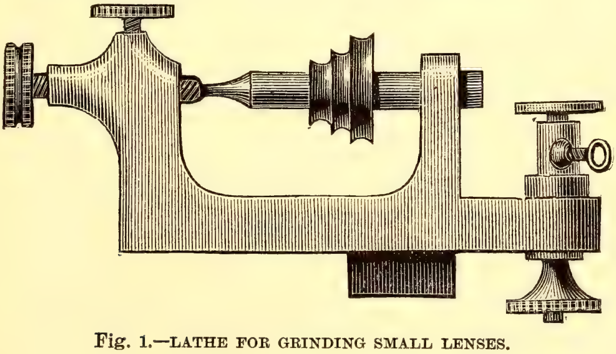


Fig. 1.—LATHE FOR GRINDING SMALL LENSES.

"For the longest radii and lowest powers the ordinary foot-lathe is suitable, but this is not so well adapted for grinding and polishing very minute lenses. A bow lathe, such as is used by watchmakers for heading their screws and other purposes,

is far preferable. This tool is represented half size in Fig. 1, and scarcely needs explanation; it has a hollow screwed mandril and T-rest, and is held in the vice by the tongue at the bottom. The pulley has three speeds, the smallest of which is $\frac{3}{8}$ inch in diameter: it should also have a socket for carrying a fixed magnifier, under which the minutest lenses are turned. The best bow is an old fencing foil ground down so as to be very thin and light. Catgut does not answer well for the string, as it soon gets frayed out over the small pulley. I have found the best packing twine preferable. During work this is kept slightly moist, and rubbed with a piece of soap; in this way a length of it will outlast a day's work, especially if a little more twisted before it is attached to the wire hook at the top of the bow. A surplus stock of string may be wound about the guard, just above the handle, so that it can be drawn out as required."

In regard to the best lathe for mounting lenses, Mr. Swift contributes the following note to Dr. Beale's, work on the microscope:

"The tool best suited for mounting the lenses in their cells is shown in the accompanying engraving (Fig. 2); this can be worked with a drill bow, or can be made to act with the foot, in the way of an ordinary lathe, which is preferable, as it leaves both hands at liberty for manipulating with the slide-rest carrying the cutter. The slide-rest, as will be perceived by the engraving, is of a very simple construction; there are two screws with milled-heads, marked A, (one of which is shown at A, Fig. 2, the other being on the opposite side, and seen in Fig. 3), for the purpose of adjusting the cutter to the diameter of a cell required to receive the lenses. These screws act in opposite directions upon a dove-tail slide, moving at right angles to the mandril of the lathe. B is a bar of metal, about 6 inches long, upon which the cutter is fixed. This bar is planed out Λ shape, and bears upon two supports of similar form. By this means a sliding motion is obtained, in a direct line with the axis of the mandril, upon which the object-cell is screwed. By moving the milled-head screw in Fig. 3, the point of which bears against a stop, any depth of cut required for the combinations can be obtained. The bar B, Fig. 2, when in use, must be held firmly on its fitting, and pushed along until the cut ceases by the point of the milled-head screw coming in contact with the stop before mentioned. Thus the required depth of the cell can easily be obtained. It is best, before proceeding to mount the combinations in their cells, to see that the mount takes a good bearing against the chuck in which it is screwed. If this precaution is not taken it often happens, after the objective is nearly finished, that the lenses first mounted are found to run untrue, owing to the main screw of the mount taking a fresh bearing by the continued screwing and unscrew-

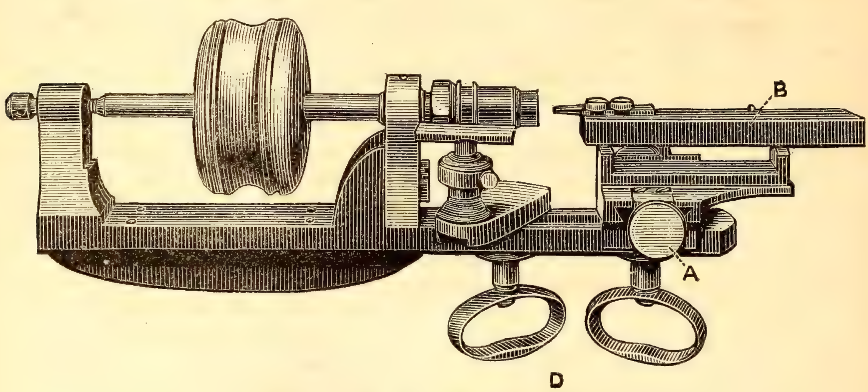


Fig. 2.—LATHE AND SLIDE REST.

ing it off and on the lathe. It will be seen that a T-rest is used in addition to the slide rest. This is handy for making chucks, for turning out the backs of the cells, etc. A rib is seen under the frame

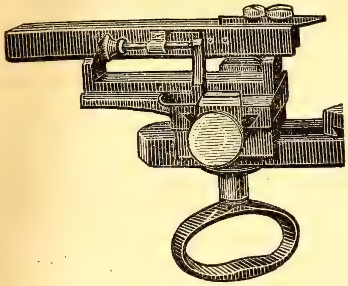


Fig. 3.—SLIDE REST.

The opposite side of the right part of the lathe represented in Fig. 2, and showing the set-screw referred to in the text.

or base of the lathe by which it is held in the vice. If worked by the foot, a wheel treadle can be easily fixed underneath the board to which the vice is bolted."

The Lathe Angle Plate.

BY JOSHUA ROSE, M. E.

THE angle plate is one of the most useful devices employed in holding lathe work, and if properly used will give the most desirable degree of truth or accuracy to the work.

Its uses may be divided into two principal classes; first, to ensure that one part of a piece of work shall be at a true right angle to another part, and, secondly, to ensure that a part of a piece of work shall stand parallel to another part.

An example of the first kind is shown in Fig. 1, in the accompanying illustrations, in which P is a pipe bend requiring to have the faces of its two flanges stand one at a right angle to the other. The angle plate, A, has its two surfaces at a true right angle; hence, when one surface is bolted to the face-plate of the lathe the other will stand at a right angle to the face-plate; hence, if one flange be bolted or clamped to the angle plate, as shown in the engraving, it will stand at a right angle to the face-plate, and the other will be turned parallel to the face-plate, or, in other words, at a right angle to its fellow.

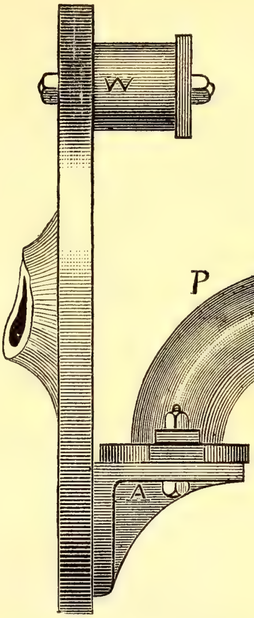


Fig. 1.

It would be a very difficult matter to chuck a pipe bend without using an angle plate. The weight, W, is employed to

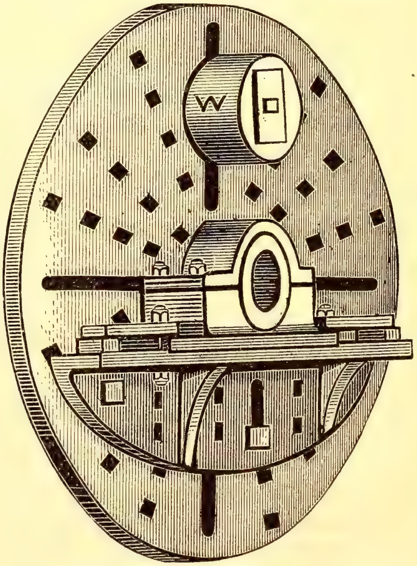


Fig. 2.

counterbalance the weight of the angle plate and the work, because it is found that unless it is counterbalanced in the latter it will be turned oval instead of round. This, however, has no effect upon radial faces, and hence would not affect the pipe bend unless the circumference of the flange required to be turned up.

In Fig. 2 is shown the angle plate employed to ensure parallelism of two surfaces. It is shown holding a pillow-block, which requires to have its hole bored parallel with the bottom surface (shown resting on the angle plate).

The slot and holes shown in the angle plate are to enable it to be moved from or towards the centre of the lathe face-plate to suit the height of the work. The bottom edge of the angle plate is made curved as shown, so as to be able to stand well out on the plate without striking the lathe bed, as it would do if the corners were left square.

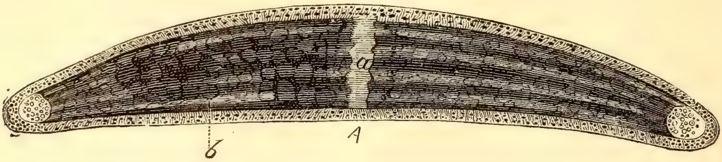
The top surface of the angle plate is provided with numerous holes to receive bolts to clamp the work, which should be held by bolts and plates as shown (and not by bolts passing through the angle plate and through the work), so as to enable setting the work true on the angle plate rather than moving the angle plate endways or on the face-plate.

In setting the angle plate for distance from the lathe centre, a piece of wood should be used, because striking the bare metal with a hammer would soon destroy the truth of the surfaces.

—In keeping living microscopic specimens in small aquaria, the chief points are steady temperature, and neither too much nor too little light. Too much light kills the animals; too little kills the plants.

Pond Hunting.

WHILE there is no doubt that the highest pleasure that can be derived from the microscope, is to be found in its successful application to the practical problems of science, or of daily life, it is also true that the next best thing is the examination of fresh, natural objects, either from the animal or the vegetable kingdom. Compared with living diatoms, desmids, or infusoria, the finest mounted objects are "as water unto wine." The one class may be beautiful, but it is dead and imperfect; the other is living with all its beauty fresh upon it. We might as well compare a fine picture or marble bust with a beautiful living woman in all the power and character of her womanhood, as to compare dead objects with living ones. Therefore, we would most earnestly advise our readers to go pond hunting, if they would get the greatest amount of enjoyment out of their microscopes.



CLOSTERIUM LUNULA.

Natural objects are not difficult to find. They abound in every pool and quiet stream. The difficulty is to find out what they are after we have got them. Knowing and feeling this, we propose to give every month one or two illustrations or pictures of such common objects as are found everywhere. These pictures will be easily recognised, and as we shall give the names and habits of the objects, our young friends will in time form new acquaintances amongst their invisible friends, which will be pleasant if not profitable.

In former numbers of the YOUNG SCIENTIST we have given accounts of the *Volvox*, the *Vorticella*, etc., illustrated with figures. In this number we give a description of one of the most common and beautiful of all the desmids—the *Clos-*

terium lunula. Specimens of this object may be found in almost any quiet pool of clear water. In general, they lie on the surface of the mud at the bottom. This should be very carefully skimmed, so as to disturb it as little as possible, and the collected water should be placed in a glass jar or tumbler, and exposed to the light. When the liquid has settled, so that it is quite clear, the dipping tube may be used to lift a little of the water from a point just over the settlings. The dip should be placed in a shallow watch glass with a flat bottom (a *lunette* glass) and examined with a low or moderate power. It is more than likely that several specimens of Closteria will be seen moving slowly across the field, or lying quietly amongst the confervæ and debris. Once seen, it will never be forgotten.

Editorial Notes.

Postage Stamps.

WE again call the attention of our subscribers to the fact, that while we take postage stamps of small denominations at full value, those of higher denominations are of no use whatever to us. We cannot sell them, except at a very great loss, and the post office will not exchange them for smaller denominations. Therefore, please do not send them.

Good News for Young Astronomers.

AT the suggestion of Prof. Wright we have decided to reproduce the Map of the Moon, after Baer & Maedler, found in "Webb's Celestial Objects," a book which is now out of print. The map will be twelve inches in diameter, and all the principal mountains, seas, etc., will be numbered, so that they may be easily referred to. Prof. Wright will, during the rest of this volume, furnish monthly notes on the *Geography* (if we may use the term) of the Moon, and will give the names and a description of all its most interesting features, as shown on the map.

This is one of the most interesting departments of astronomy, and the only reason why it has not been more generally cultivated is that good maps of the moon have not been readily accessible to amateurs.

As this map forms a somewhat expensive supplement to such a low-priced journal as the YOUNG SCIENTIST, the following are the conditions upon which it will be sent out: To non-subscribers the price will be fifty cents per copy, and it is cheap at this rate; to all whose names are now on our books, and whose subscriptions are paid for 1880 (at whatever rate), it will be sent free. *After* the issue of this number it will be sent only to those who pay the full subscription price for the YOUNG SCIENTIST—50 cents per year. It will not be sent to those who take the YOUNG SCIENTIST at club rates, or where a premium is given to the sender of the club. The map will be sent out with the March number.

Amateur's Hand-Book.

TO save disappointment, it may be well to notify our readers that the "Workshop Companion" contains *all* the matter that is found in the "Amateur's Hand-Book." Those, therefore, who buy the "Workshop Companion" do not need the "Hand-Book."

Work and Luck.

MOST people like to be astonished and to have their faculty of wonder excited, and nothing excites this feeling more than the contemplation of a result, the causes of which do not seem to be sufficient. When we see, for the first time, a weak man raising a heavy weight by means of a lever, we are struck with wonder, because, it does not seem possible that the use of a slender bar can add so much to the man's strength, and when we see a pressure equal to many tons exerted by the forcing in of a little water into a cylinder, we have the same feeling.

We all like to see and to hear of wonderful things. But when we come to understand the causes which produce the results which have astonished us, we no longer wonder. We find that in every case the cause and the effect are precisely equal, and we use levers and hydraulic presses without being in the slightest degree surprised at the effect produced by

them. What is true in mechanics, is true of mind. Every result is produced only by a sufficient cause, and we never find that any one becomes an expert without long and earnest work.

Literary men who wish to make their writing more pleasing than instructive, are very apt to pander to the feeling of pleasure which we all take in wonderful stories, and they have filled the history of science with fables in which they tell us that almost all great discoveries were the result of accident. Thus we are told that the Galvanic battery owes its origin to some frog's legs, prepared for soup for Madam Galvani, and hung on an iron railing. The wind blew and moved the legs away from the metal, and then allowed them to fall against it again, and every time they touched the iron they gave a convulsive twitch. Galvani saw it and invented the galvanic battery.

This whole story is a fable. At the time spoken of, Galvani had been engaged for years in experimenting on animal electricity, and had often used frog's legs as electroscopes, but in spite of all this, he did not invent the battery which was devised some years after Galvani's death, by Volta, and should be called the *Voltaic*, and not the *Galvanic* battery.

The same class of writers tell us that Newton was led to his famous discoveries by the falling of an apple as he sat in his garden. The most careful research fails to find any ground for this story. Newton was engaged for years in working out his famous discoveries ; he was not led to them by any accident, but by honest hard work.

Another story is that told of Galileo, that he invented the pendulum from seeing a chandelier swinging in a church. Pendulums had been used long before his day, and at the time he saw the chandelier he had been studying the subject for years, and merely used it as an illustration of the great laws which he was endeavoring to work out.

Another story is that of Watt, who is said to have invented the steam engine from seeing the steam lift the lid of a kettle as he sat by his mother's fireside. Now it happens that steam engines were in extensive use in Great Britain long before Watt was born, so that the power of steam was well known. Watt, however, made a careful study of the properties of steam, and experimented upon the subject until he was familiar with all the facts in the case. After this hard work and experimenting, he was able to so improve the steam engine of his day that his fame will last as long as our modern civilization endures.

The lesson to be drawn from all this is, that if we would succeed, we must depend upon good hard work and not upon luck. Luck rarely does much for any one, and if we wait for accidents to help us, we may wait in vain for ever.

Designs for Scroll-Sawyers.

MR. HODGSON, whose admirable articles on scroll-sawing are now in course of publication in the YOUNG SCIENTIST, has prepared for us a series of seventeen designs covering a great variety of subjects suitable for Christmas presents and ordinary articles of household ornament and utility. These designs we have had photo-lithographed and printed on two large sheets. They are full size and embrace over eighty different pieces. Knowing that this set must have a large sale, we have placed the price at 25 cents for the set, or a cent and a half for each design. We know of no designs equal to these which can be had for less than five, ten, or twenty cents each.

To any boy or girl who will send us a new subscriber to the YOUNG SCIENTIST (together with their own subscription) we will send a set of these designs free. The subscriptions may be for 1878, 1879, or 1880. Remember, one of the subscribers must be new. It will not do to send a renewal of the subscriptions of two old subscribers.

BOOK NOTICES.

Laboratory Teaching: or, Progressive Exercises in Practical Chemistry. By Charles Louden Bloxam, Professor of Chemistry, in King's College, London. etc., etc. Fourth Edition, with Eighty-nine Illustrations. Philadelphia: Lindsay & Blakiston.

This is a most excellent little book, clear and full on all those points in which the beginner re-

quires instructions. It gives full directions for the performance of such operations as are required to illustrate chemical principles, and also gives directions for analyses. Students who desire to get a book which will help them to a knowledge of practical chemistry, cannot select a better.

The Boston Journal of Chemistry. Devoted to the Science of Home Life, the Arts, Agriculture and Medicine. $1.00 per year. Boston Journal of Chemistry Co.

This able and interesting journal is now in its fourteenth year, and every season it grows better and better. To those who wish a wide awake journal which gives a view of recent scientific progress, without making any heavy demands upon purse or time, we would recommend the *Boston Journal of Chemistry.*

Astronomy for Amateurs.

BY BERLIN H. WRIGHT.

(Calculated for the Latitude of New York City.)

THE PLANETS—MARCH, 1880.

	D.	*H.*	*M.*	
Mercury sets	7	7	23	evening
" "	10	7	33	"

(10° N. of sunset point at close of ev'g. Twilight 1h. 30m. after sunset.)

	D.	*H.*	*M.*	
Venus rises	10	5	5	morning
" "	30	4	53	"
Mars sets	10	0	59	"
" "	30	0	33	"
Jupiter	invisible			
Saturn sets	10	7	58	evening
" "	30	6	52	"
Uranus in Meridian	10	11	17	"
" "	30	9	55	"

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS, MARCH 21, 1880.

	H.	*M.*	
Alpha Andromedæ (Alpheratz) sets	7	54	eve.
Omicron Ceti (Mira) sets	8	2	"
Beta Persei (Algol) "	0	13	morn.
Eta Tauri Alcyone or Light of Pleiades) sets	11	9	eve.
Alpha Tauri (Aldebaran) sets	11	27	"
Alpha Aurigæ (Capella) "	3	20	morn.
Beta Orionis (Rigel) "	10	40	eve.
Alpha Orionis (Betelguese) "	0	18	morn.
Alpha Canis Majoris (Sirius or Dog Star) sets	11	41	eve.
Alpha Canis Minoris (Procyon) sets	1	56	morn.
Alpha Leonis (Regulus) in Merid.	10	2	eve.
Alpha Virginis (Spica) rises	7	56	"
Alpha Bootis (Arcturus) "	6	59	"
Alpha Scorpionis (Antares) rises	0	6	morn.
Alpha Lyræ (Vega) rises	9	39	eve.
Alpha Aquillæ (Altair) rises	1	19	morn.
Alpha Cygni (Deneb) rises	10	42	eve.
Alpha Pisces Australis (Fornalhaut)	invisible		

NEAR APPROACH OF THE MOON TO STARS AND PLANETS, ETC.

March 3. Moon near Antares.
" 4. " in Milky Way.
" 5. " 2° N. of "Milk-Maids' Dipper."
" 8. " 3° South of Venus.
" 9. " 10° South λ in Aquarius.
" 10. Mercury 18° 22′ E. of Sun (*Gr. Elong.*)
" 11. Moon 6° North of Jupiter.
" 12. " 3° North of Mercury.
" 12. " 8° North of Saturn.
" 15. Jupiter in conj. Sun (*Invisible*).
" 15. Moon a trifle North of Pleiades.
" 16. " North of Hyades.
" 17. " very close to and North of Mars.
" 18. " 15° North of Betelguese.
" 20. " Midway bet. Castor and Procyon.
" 20. Sun Enters the Sign Aries (Constellation Pisces) and Spring commences.
" 23. Moon 5° South of Regulus.
" 24. " 5° " Uranus.
" 26. " very close to Spica.
" 28. Mercury, inferior conj. with Sun.
" 28. Moon within the Square of Libra.

GEOGRAPHY OF THE MOON.

We herewith begin a series, as indicated by the heading, upon the natural divisions or surface of our satellite. We shall confine our observations to a class of objects which may be easily seen with small telescopes in the hands of amateurs.

The Moon is the easiest of all celestial objects, being only about 240,000 miles distant, and subtending an angle of about one-half of a degree. Ever since the time of Galileo, who first discovered the mountains and valleys on its surface, the Moon has been the object of unceasing observation. Amateurs were, however, debarred from a careful and comprehensive study of lunar geography by the lack of a good map, adapted to their purposes. This want was supplied in 1859 by the Rev. T. W. Webb, who reduced "Mappa Selenographica," which was originally issued in four large sheets, and omitted a vast amount of detail, such as would only tend to confuse and discourage the beginner. The work with which that map was issued ("Celestial Objects for Common Telescopes") has long since been out of print, and is now costly and hard to procure.

The Editor has prepared the way for a rich feast for the student of Astronomy, by faithfully reproducing this map in full.

In order to avoid crowding on the map, each object is numbered, and in referring to them we will give the name by which it is known, and in parentheses the number by which all may be, in time, identified and observed under the most favorable circumstances.

It will be noticed that, as in terrestrial maps, North is at the top and South at the bottom of the map, but East and West are reversed; that is, East is at the *left* and West at the *right*. Hence, when observing the Moon and using a terrestrial eye-piece, it will appear as represented in the map; but while using an inverting eye-piece and comparing, the map should be inverted, so that S. will be at the top and N. at the bottom, then W. will be at the left and E. at the right.

The First Meridian and Equator are the only great circles represented, and these divide the map into four quadrants, which are called the 1st or NW., 2d or NE., 3d or SE., and 4th or SW., Quadrants.

Nothing is to be gained by the use of high powers. A good telescope, with a clear aperture of three inches, ought to bear a power of 450, and it will be found that nothing can be gained by the use of higher powers. Indeed, for most purposes in lunar observations, a much lower power is preferable.

Very much depends upon the age of the Moon at the time of the observation, as many remarkable features which are plainly visible at certain times or at a particular age of the Moon, are either wholly invisible at the full or are very unsatisfactory. Hence, in future articles, we will instruct as to when to look for these things.

It would be well to mount the map upon a piece of firm cardboard large enough to leave a margin of two inches all around, so as to have it in convenient shape for reference, and not damage it with finger marks.

The writer will give careful attention to all letters of inquiry regarding telescopes, etc., which may be suggested by these articles.

Penn Yan, N. Y.

Correspondence.

A Cheap Telephone.

Ed. Young Scientist—To make a cheap and serviceable telephone good for three blocks or so, only requires enough wire and two cigar boxes. First, select your boxes and make a hole about half an inch in diameter in the centre of the bottom of each, and then place one in each of the houses you wish to connect, then get five pounds of common iron stove pipe wire—you can take back what you don't use—make a loop in one end and put it through the hole in your cigar box and fasten with a nail; then draw it *tight* to the other box, supporting it when necessary with stout cord. You can easily run your line into the house by boring a hole through the window sash, or cutting a hole through the glass. Support your boxes at their ends with slats nailed across the window, and your telephone is complete. I have one that is two blocks long, and cost forty-five cents, that will carry music when the organ is played thirty feet away in another room. There are quite a number of lines like this in town. HARRY HOLDEN.

Black Earth, Wis.

Examining the Bottoms of Ponds and Rivers.

Ed. Young Scientist—In the last issue of the YOUNG SCIENTIST, there is a very interesting article on the use of mirrors for examining the bottoms of wells, ponds, and rivers. I have used mirrors for this purpose, and can endorse all that is said of them. In the case of ponds and rivers, however, something more is needed as the reader will find if he tries. Some years ago, while fishing in a somewhat deep lake from a boat, I had the misfortune to lose a valuable little rifle. We marked the place pretty carefully, buoyed it, as I believe the sailors call it, and tried to work out some plan by which it might be recovered. We even had thoughts of employing an expert swimmer to dive for it, but could not find one in the neighborhood. In this dilemma our old Professor of Natural Philosophy (of Physics he called himself,) came to our aid. He never was happier than when helping us boys, provided he could teach us at the same time, and you may readily believe that under such circumstances we were glad to learn. The Professor armed himself with a large mirror (it was at least two feet long and of proportionate width), a thick horse blanket, a large hoop from a hogshead, a powerful compound magnet, and some stout cord. When we reached the spot in the boat, the buoy was still there, and we anchored as close to it as possible.

The Professor tied the magnet to the cord, and arranged the blanket over his head so that the ends dipped into the water and excluded all light except what came *up through* the water. The hoop enabled him to form a sort of tent, so that he had room to work. We had, of course, chosen a bright day, but alas for Old Probabilities, it clouded up just as we got afloat. This, however, did not seem to disconcert our Professor. His original plan had been to throw the sun's rays to the bottom of the lake by means of the mirror, and he, being in total darkness, except for the light coming from the bottom of the lake, would be enabled to see any object lying there. Now, however, he took from his pocket a bit of magnesium ribbon, and we set it on fire outside his tent Of course we held it so

that it lighted up the bottom of the lake, and to add to the brilliancy the mirror was held so as to throw down all the rays possible.

After two or three trials in different places we heard the Professor exclaim "I see it, steady boys!" and steady it was. The magnet was lowered, a little more magnesium was burned to enable the Professor to adjust it properly, and up came the rifle.

On the way home the Professor told us that if the water had been rippled the blanket dipping into it would have kept a still place. If too rough, he could have made a water tight tube in two divisions and with a glass bottom. Down one division he could have sent the light, while he looked through the other.

Sunlight, of course, is best, but when sunlight is not to be had, magnesium is a very good substitute, and where magnesium cannot be had, a light may be made by filling a paper tube with blue light mixture* and burning that. The materials may be had in any country drug store

AN OLD BOY.

Plaster of Paris.

Before the establishment of cement mills, plaster was only used by stucco men, and these had generally to prepare it for their own use; the gypsum was never burnt, at least by those who did fine work; the term was "boiled," not "burnt;" the raw gypsum was pounded and sifted, and the water of crystallization was driven off in an open pot or pan, the powder being stirred the while; during which operation it assumed all the appearance of a fluid, owing to the rapid escape of the steam) especially from the lower stratum, which kept the whole mass alive, so that when the surface was disturbed it immediately assumed its own level. When all the water was expelled this peculiarity ceased, the gypsum was given a good heat, so as to make sure of its being thoroughly dried, but not by any means to burn it or let it get red-hot, which was reckoned to spoil it, as if overheated it set too quickly, or merely acted as common lime.

In mixing for use, plaster ought to be added to water, not the water poured on to the powdered plaster. And if any coloring matter be used, such as red ochre, it ought to be first mixed with the water, so as to insure equable distribution; if a hard material be required, add alum or sulphate of sodium (Glauber salts) to the water. These cause the plaster to set with great rapidity, but should it be wished to delay the setting, mix with a weak solution of glue or gelatin. The stucco men use this in order to give time to trim mouldings, etc. For fine work the plaster may be sifted again after being boiled. It may be kept for any length of time, if kept perfectly dry and in a place or vessel where it cannot imbibe moisture from the atmosphere. Should this take place, no boiling or burning will again revive it.—*English Mechanic.*

* Directions for making all kinds of lights will be found in the "Workshop Companion."

How to Loosen Screws.

Few things are more vexatious than obstinate screws, which refuse to move, much less to be drawn out, and in the struggle against screw-driver power suffer the loss of their heads, like conscientious martyrs, rather than take a single half-turn backwards from the course they have followed, and from the position they have been forced into. Like obstinate children, they must be coaxed, or rapped pretty hard on the head, according to circumstances; in fact, whoever has a tight, obstinate screw, to "draw out," must keep his temper down and his resolution up, quite as much to the sticking-point as the screw does. If the screw is turned into iron and not very rusty, it is only necessary to clear the head with the wedge of the driver, and let a few drops of oil penetrate to the threads; but, finding that excessive heat or rust has almost fixed the screw immutably, then heat, either by placing a piece of hot iron upon it or directing the flame of the blow-pipe upon the head, and, after applying a little oil, turn out gently; but care must be taken not to let the tool slip so as to damage the notch. If, however, the screw refuses to come out, try to force it back with a blunt chisel, smartly but carefully tapped with a light hammer; but if evidently nothing can dislodge the enemy, it is best to cut the head away and drill out the screw. When an obstinate screw happens to be in wood, merely give it a few taps on the head; but failing that, heat it with a piece of hot iron, when it may be easily turned.

Practical Hints.

Keeping Mice From Seeds.—Any one desirious of keeping seeds from the depredations of mice, can do so by mixing some pieces of camphor gum in with the seeds. Camphor placed in drawers or trunks will prevent mice from doing them injury. The little animal objects to the odor, and keeping a good distance from it, he will seek food elsewhere.

Marking Tools.—Much trouble can often be saved by marking tools with their owner's name, which can be easily done in the following manner:—Coat over the tools with a thin layer of wax or hard tallow, by first warming the steel and rubbing on the wax warm, until it flows, and let

it cool. When hard, mark your name through the wax with a graver and apply aqua-fortis (nitric acid); after a few moments, wash off the acid thoroughly with water, warm the metal enough to melt the wax, and wipe it off with a soft rag. The letters will be found etched into the steel.

Transferring Pictures to Glass.—Coat the glass with a varnish of balsam of fir in turpentine, then press the engraving on smoothly and evenly, being careful to remove all air-bubbles. Let it stand for twenty-four hours, then dampen the back sufficiently to allow the paper to be rubbed off by the forefinger, rubbing it till a mere film is left on the glass, then varnish again.

Cementing Glass to Metal.—A great deal of difficulty is experienced in cementing metal to glass. The *Faerber Zeitung* says that a mixture of two parts finely ground litharge and one part white lead, and working it up to a stiff paste with three parts boiled oil and one part copal varnish, adding more litharge and white lead as required, is the best material for joining the two substances.

Phosphorescent Powders.—A powder which after being exposed to strong sun-light, continues to emit light in the dark and so serves to render barometers, compasses, etc., luminous, is formed thus: Grind and ignite a mixture of 100 parts carbonate and phosphate of lime (obtained by the ignition of shells, especially *Tridama* and *Sepia*) with 100 parts quick-lime, 25 parts of calcined salt, and 25 to 50 per cent of the whole mass of sulphur. Then add 6 to 7 per cent. of a coloring matter—a sulphide of calcium, strontium, barium, magnesium, aluminum, etc. This powder is particularly phosphorescent under the influence of an electric current.

To Prevent Rusting.—1. Boiled linseed-oil will keep polished tools from rusting if it is allowed to dry on them. Common sperm oil will prevent them from rusting for a short period. A coat of copal varnish is frequently applied to polished tools exposed to the weather. Woolen materials are the best for wrappers for metals. 2. Iron and steel goods of all descriptions are kept free from rust by the following:—Dissolve ½ oz. of camphor in 1 lb. of hog's lard, take off the scum, and mix as much black lead as will give the mixture an iron color. Iron and steel and machinery of all kinds, rubbed over with this mixture, and left with it on for 24 hours, and then rubbed with a linen cloth, will keep clean for months. If the machinery is for exportation it should be kept thickly coated with this during the voyage.

To Make Badly-fitting Blinds and Doors Shut Tightly.—When blinds and doors do not close snugly, but leave cracks through which drafts enter, the simplest remedy, recommended by Mr. Schuetse, building commissioner in Dresden, Germany, is this: Place a strip of putty all along the jambs, cover the edge of the blind or door with chalk, and shut it. The putty will then fill all spaces which would remain open and be pressed out where it is not needed, when the excess is removed with a knife. The chalk rubbed on the edges prevents the adhesion of the putty to the blind or door, which can then be opened without adhesion, and the putty is left in place, where it soon dries and leaves a perfectly fitting jamb. Any smart boy can do this.

EXCHANGES.

Wanted, a cornet; must be in excellent order, state what is wanted in exchange. James B. Athearn, New Bedford, Mass.

Wanted, Archæological relics and fossils, for butterflies, beetles, spiders, etc. Correspondence invited. A. W. Baily, Box 195, Pottstown, Penn.

Idaho cabinet minerals, books, revolver, stencil outfit, an electrizer, for well-bound books of travel, biography, history, science, masonry and others of an instructive nature. J. P. Clough, Junction P. O., Lemhi Co., Idaho,

Telegraph instruments with 400 feet of wire and battery, it cost $12; will exchange for scroll saw, or offers. F. Cushing, Wattsburg, Erie Co., Penn.

An improved camera lucida for drawing, etc.; also, a printing press, chase 2½ x 3½, for offers. L. De Veau, 87 E. 10th St., New York.

What offers for a magnificent black walnut mineral cabinet, 5 ft. x 4 ft., desk form, and double, has 4 glass doors, 12 drawers, veneered panels, with drop handles, massive carved legs, and is lined in blue, cost $80 cash. W. L. Farnum, Owosso, Mich.

Postage stamps, spectograph, drawing cards in case, sketch blocks, size 12x20 and 9x12 in., one book, "No Alternative," for minerals, coins, birds eggs, Indian relics or offers. Frank F. Fletcher, St. Johnsbury, Vt.

To exchange: well-mounted slides of hair and fur, for other well-mounted slides of same, lists exchanged. Address, W. Hoskins, 208 S. Halstead St., Chicago, Ill.

Rare insects, minerals, and shells, in exchange for scientific books. P. W. Lee, 310 Marlborough St., Boston, Mass.

A set of carving tools worth 75c.; card stamp and type worth $3.00. State offers, magic lantern preferred. Address Frank H. Libby, Saco, Maine.

A first class sewing machine will be exchanged for books or offers. Address, Lock Box, 22 Schoharie, New York.

Gaskel's compendium, and Virgil's works translated by Dryden. State offers. G. Osgood, Jr., Abington, Mass.

Cocoons of attacus cecropia or mounted specimens of Lepidoptera to exchange for the following cocoons: "A. Luna," "A. Prometheus," "Saturnia Io," a "Ceratomia quadricornus." R. Perry, 50 E. Washington St., Indianapolis, Ind.

Wanted, in exchange for one vol. of "The Boys of New York," or the "Young American," a two line card printer with type and everything complete. Address, W. H. Pretty, Bellville, Ont., Canada.

Wanted, to exchange, Lake Superior copper specimens for type. T. J. Prince, Houghton, Mich.

For exchange, a small lathe, (foot power), 2 sewing machines, 1 Wheeler & Wilson, 1 Singer, medium, in good order, but little used; wanted cabinet makers tools, tent, or scroll saw. R. P. Wakeman, Southport, Conn.

The Young Scientist

SCIENCE IS KNOWLEDGE. KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

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Horn, and How to Work It.

OF late years horns of great size and excellent quality have become comparatively common in many of our large cities, and are, therefore, not difficult to procure. Our young friends can make a great variety of useful and pretty things out of them, and therefore a few hints concerning the best methods of working this material cannot fail to prove acceptable. In the arts, horn is used for a great variety of purposes. First of all we have the traditional use to which horns were first put, viz.: musical instruments—and although "horns" are now made of anything but *horn*, still it is a fact that the hunter of old generally used the horn of the wild bull or buffalo as an instrument by which to call together his companions, or to indicate to them, by certain prearranged signals, the character and direction of the chase.

In the olden times drinking cups were generally made of horn, and even now the phrase "taking a horn" is used metaphorically for taking a drink. Amongst other household articles made of horn were spoons and shoe-horns, or shoe-lifters, both of which are now generally made of metal. Of the fact that spoons were made of horn a memento still exists in the proverb—"I will make a spoon or spoil a good horn."

Before the days of metallic cartridges and powder flasks, powder was carried in horns, and powder flasks are still sometimes called "powder horns." It is not many years since most combs of the cheaper and commoner kinds were made of horn, and the finer and clearer specimens of this material were used for making boxes and frames, and cases for magnifiers and other optical instruments. Mathematical instrument makers also use thin sheets of horn for making protractors, and templates for irregular curves. These thin sheets have long been used for making lanterns, or lanthorns (*lamphorns*) as they are sometimes called, but of late years mica has taken the place

of horn, being more transparent and much cheaper.

The best horns come from South America. The Cape of Good Hope and the East Indies also yield a large supply of very excellent horns. Of late years the Texan herds of cattle have furnished large quantities, but other materials, such as vulcanite and celluloid, that are more easily worked, and that give better results, have lessened the demand, and consequently rendered them less valuable.

Horn consists chiefly of hardened gelatine, and although it cannot be reduced to glue by boiling, it can be softened by heat so as to be readily moulded into almost any form. The horn, as it grows on the animal, consists of concentric layers of this peculiar material, which are cemented together with a firmness that varies at different parts of the horn. Thus, at the base or part next the head, the layers are easily separated, and consequently the horn is loose and easily split at that part. On the other hand the tip is so hard and solid that it is very difficult to split, and hence is used for such work as making the tips of bows, etc.—purposes which require very hard and tough material. A knowledge of the different qualities of the different parts is necessary to those that would work this material successfully.

In preparing horns to be worked, the first step is to free them from everything except the pure material known as horn. This is most easily done by steeping or macerating the horns in water. This process requires nearly a month; the horn itself does not putrify, but the cores and other parts do, and are then easily separated. The horns are then thoroughly washed in weak lye (not soaked, however) and are ready for the next process, which will depend upon the purpose for which the horn is wanted. Thus the horn may be used whole, as for musical and sound-giving instruments, powder horns, etc. Or it may be left in its original form, but used in parts, as for drinking cups. Or it may be formed into flat plates as for combs, or thin sheets for lanterns, or it may be moulded into such objects as boxes, cups, etc. And the best way to tell our readers how to go work will be to take up these different objects, one by one, and tell how each is made.

Let us suppose, then, that the reader has a fine specimen of horn, out of which he wishes to make a powder flask. The first thing will be to decide as to the mountings. If he intends to pursue the old plan he will simply plug the large end, bore a hole through the tip or small end, and use a neatly-carved or turned plug of bone or wood as a stopper. In this case the powder is simply poured out into a measure or into the hand and transferred to the gun. Amongst the Seminole Indians an alligator's tooth used to be a favorite powder measure.

If, instead of a simple plug, a metallic mounting should be preferred, then the best plan is to procure a good spring top, such as is used on the best metal flasks. Such tops might perhaps be procured through some gunsmith from the manufacturers. The horn must then be cut off at the tip end, a little *above* the point at which the diameter of the horn is the same as that of the mounting. It can afterwards be cut off so as to fit exactly.

Provision must also be made for attaching rings by which the horn may be suspended by cords. These rings must not be screwed or riveted into the horn, as the beauty of these flasks is their excessive thinness and lightness—the grains of powder actually appearing distinctly through the sides. This renders the horn very slight and delicate, and the only way to attach the small rings for the cord is by means of two large, thin rings or ferrules, which go entirely round the horn and are prevented from slipping off by means of two or three rivets. These large rings may be of silver or, what is better, of brass or steel, heavily nickel-plated. Silver is easily discolored by gunpowder, while nickel is not.

Having arranged for the mountings, the next step is to prepare the horn. If the tip is to be left on, the upper end of the horn is hollowed out by boring with a half-round bit. If the tip is cut off so as to leave a large hole in the upper end, the inside of the horn is finished by scraping. The inside must be well scraped, so as not only to remove any membranes left after

the core has been taken out, but to make the inside quite smooth and polished, as upon this the beautiful transparency of a well-made powder horn chiefly depends. Consequently, while we may use files and riffles for the beginning of the work, we must soon give them up for a steel scraper made out of a bar or rod of steel, of which the end has been bent square and properly ground and sharpened. The edge of the scraper should be very sharp and finely finished on an oilstone. It will not do, however, to depend upon the scraper altogether, as this tool is very apt to work the material into ridges or *utters* as they are called. Bent files, called *riffles*, must be used for *straightening* the surface, and the scraper must be confined to its proper office of smoothing. The same process must also be applied to the outside, which must be worked down until the surface is perfectly even.

In the meantime care must be taken to leave the lower end of the horn so thick that a groove may be cut in it to receive the bottom. In the common horn flasks the bottom is made of wood simply fastened with tacks or screws, but this makes an unsightly finish. The proper way is to cut a circle or disk of horn out of a flat piece, and fasten this in a groove, which is done as follows: The end of the horn having been cut off square and even, a groove is cut round the inside at a very short distance from the edge—say one-eighth of an inch. To cut the end square take a piece of paper with a straight edge, wrap this round the horn, mark the line with a fine pencil, and cut off the horn with a fine, sharp saw. The edge is made perfectly smooth and straight by means of a small plane, for which purpose the little cast-iron planes, now so common, are excellent. The groove is cut by means of a tool like a cooper's croze or carpenter's marking gauge. The gauge has, instead of a point, a hook-shaped cutter, which cuts a clean but not very deep groove round the inside. The flat disc is then turned up in the lathe so as to have a ridge on the edge, this ridge just fitting the groove. The disc is made a very little larger than the opening into which it is to fit, and the latter is expanded by plunging the horn for a few minutes into boiling water. The horn softens and expands so that the disc is easily forced into its place. When the horn cools it shrinks on the disc so as to make it very firm.

Before fastening the disc in its place, however, the surface of the disc and the inside of the horn should be finely polished. This is neccessary for the purpose of rendering the flask transparent, for no matter how thin the horn may be scraped it will not be transparent unless it is finely polished. This is seen in glass, very thick plates of which are quite transparent when the surfaces are polished, but lose this quality when the surface has been ground or slightly roughened.

Horn is polished by being first smoothed by means of the steel scraper; then it is worked with the finest pumice-stone or rotten-stone, and oil or water, a piece of leather being used as a rubber; after this it is polished by means of fine, washed putty powder mixed with water or oil, and rubbed on with cloth or leather. The very finest finish is given by rubbing with the naked hand in the same way that tortoise-shell and papier mache are polished.

After the inside has been polished and the bottom fastened in, the projecting edge of the horn is rounded and the entire outside is polished by the same process that has been described for the inside.

Previous to the polishing of the outside, the mountings should be carefully fitted to their places, and in the case of horns which are not cut off pretty well down, the outside should be polished and the rings riveted on before the bottom is put in, as it will be impossible to do it afterwards. When a spring top is to be attached the opening will be large enough to allow of the riveting of the rings *after* the bottom has been fastened and the horn polished. No grooves should be cut for the rings. They should simply be driven on tightly and fastened with one or two very slight rivets.

The top may be screwed on, or fastened in any other way that will make a good job. As, however, our object is to tell how to work *horn*, it is unnecessary to describe them. In our next article we will tell how to work horn into other forms and articles.

Home-Made Telescopes and Microscopes.—III.

CUTTING AND ROUGHING OUT THE GLASS.

WHEN ordinary plate glass is used for simple lenses it is generally cut into squares by means of a common glazier's diamond, and these squares are worked into shape either by grinding or by means of a pair of soft pliers. The pressure of the pliers, applied near the edges of the glass, cause it to crumble away in small fragments, and the process, which is called *shanking* or *nibbling*, is continued until the pieces are made circular and of a diameter a little larger than the finished size of the lenses. If we wish to make a plano-convex lens and it is found, after careful examination, that the surface of the plate glass is sufficiently smooth and even to answer without further grinding or polishing, this surface should be protected from scratches by having a piece of paper pasted over it. After the glass has been roughed out to nearly the right size, the paper should be soaked off and the plane side of the glass cemented to a metal or wooden handle. The cement will protect the surface.

If, however, the lenses are to be ground out of discs or blocks of glass, such as are sold by the dealers in optical glass, then a different plan must be pursued. Glass of this kind is too costly to be wasted by breaking it into irregular fragments; it should be sliced into plates of proper thickness by means of a lapidary's slitting machine. This is simply a disc of thin sheet iron which is mounted on a mandril and turned up true and smooth. It is of importance that the edge of the slicer should be quite true and free from even minute notches. In the usual lapidary's slitting machine, the slicer runs horizontally, but it may just as well run vertically and so be used in a common lathe.

To charge the edge of the slicer, or to *season* it, as it is called, requires some care. The diamond powder is easily procured from dealers in fine tools, and should be quite fine. It is mixed with a little oil in a small glass cup or pot provided with a cover. To apply it to the edge of the iron disc, a little is taken up on a small spoon made out of a quill, and the hollow of the quill, holding the diamond powder, is held against the edge of the slicer until the latter is coated. The diamond particles must now be forced into the metal, and this is done by holding a flat piece of hard stone, such as agate or flint, against the edge. Care must be taken not to allow the slicer to cut into the flint or agate, as this would force particles of diamond into the sides of the slicer where they are not wanted. As soon, therefore, as the slicer begins to *cut* the stone it must be shifted to a new place. As soon as the small quantity of diamond resting on the edge of the slicer has been forced into it, the margin of the slicer is carefully wiped on both sides with the forefinger, in order to remove any small portions of the diamond that may have become accidentally lodged on the sides, and these particles are pushed to the edge of the slicer and pressed in with the charging stone. After the edge of the slicer has been once fairly charged with the diamond powder, a single application is generally sufficient for restoring the cutting edge, and under the hands of the practical lapidary a single seasoning will endure several hours work.

We have given these directions because professional lapidaries are inaccessible to most of our readers. Where the worker wishes to get along with cheaper and simpler means, the following directions by Mr. Wenham will be found valuable:

"Pieces of glass may be readily sliced with a circular disc of soft iron, running in the foot-lathe, and fed with flour emery and water; the edge of the slicer must be frequently notched with the sharp angle of an old file. The sample of glass or mineral is cemented to the end of a staff, and held preferably in the slide-rest. If the screw of the rest is taken out and the slide made slack, the work can be thrust up to the slicer with the pressure of the fingers, and there is less risk of fracture from undue violence. The sliced glass is cut into squares, a little exceeding the diameter of the intended lenses, by means of a glazier's diamond, and the corners rounded off with a pair of optician's

"shanks" or nibblers, which are a species of pliers, made, in preference, of soft iron, as this grips the glass without slipping, as hard steel would do. This instrument, of a larger size, is capable of removing slivers of glass from the edges of a plate upwards of one inch in thickness.

"All glass is much softer than hardened steel; but if this is set to cut in a dry state, the heat generated at the working or abrading point softens the cutting edge, and speedily destroys its action; but if some turpentine is applied, this quite prevents the softening of the tool. In the lathe, or with a common Archimedean drill, holes may be drilled through thick plate-glass with surprising rapidity, if kept well bathed in turpentine. Masses of glass may also be turned in the lathe with a steel tool, if plentifully supplied with turps, and run at a moderate speed.

"The first experimental parabolic condensers were made from plate-glass 1½ inches thick; pieces of this nibbled rudely to form, were cemented on to a chuck. The T-rest was next placed nearly on a level with the top of the work, and an old triangular saw-file, kept sharp *on one side only* by repeated applications to the grindstone, was then held on the rest, so as to attack the revolving glass slantways, or spoke-shave fashion, with plenty of turpentine. By these means the glass was quickly reduced to form, so as to fit the template; and the ridges left by the file were swept away by means of small leaden laps, fed with emery and water of increasing fineness. The polish was obtained by a rubber of willow-wood, cut crossways of the grain, used with crocus (peroxide of iron) and water, and at last a lump of beeswax with very fine crocus was employed for the final polish.

"For working small concave lenses, as nearly as possible to their final form, a great deal of accurate and skilful turning is required. For this delicate work steel tools are quite unsuited, and diamond points are invariably used. The common practice of mounting these has been to solder them with brass and borax, by means of the blow-pipe, into the end of a steel tube about the size of a watch-key, leaving a hole behind to prevent the diamond from being blown out during the fusion; but I have never found this method secure for small splinters. The brass has really no affinity for the diamond, but rather tends to avoid it; and this is frequently only held in by the glaze or flux. The loss of several diamonds induced me to abandon this practice, and since adopting the following mode I have never lost one.

"I take a piece of copper wire, about 1-12th of an inch thick, and drill a shallow hole in the end, of the size and depth required to contain the diamond, Fig. 4. A

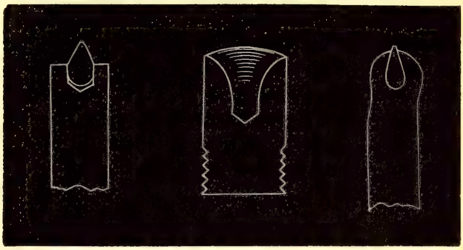

Fig. 4. Fig. 5. Fig. 6.

piece of steel, turned out with a bell-mouth, and hardened, is shown in Fig. 5. This is spun rapidly in the lathe, a drop of oil is applied, and the end of the copper rod containing the diamond is pressed hard in, at the same time giving it a slight rolling motion. Speedily the copper is compressed tightly round the diamond, as in Fig. 6, which becomes very firmly imbedded in the soft metal; and if the operation is carried too far, the copper rises over the point and completely buries the splinter.

"By mutual abrasion, the diamonds rapidly grind each other away, and two, mounted in wires in this way, may be kept mutually to a sharp point by chucking one in the lathe and using another as a turning-tool. In employing these diamonds for turning glass, no particular directions are needed; they seem to cut rather better if the work is kept slightly moist.

"The most convenient way, for the amateur, of reducing the substance, or giving the rough rounded form to small lenses, is a large plate of zinc and coarse emery and water; iron is too hard, lead too soft, and copper poisonous."

Parallel Pieces and Parallel Strips.

BY JOSHUA ROSE, M. E.

PARALLEL pieces for lathe work are pieces of metal of parallelogram form, employed to hold work away from, but true with, the lathe face-plate. Parallel strips are similar pieces (usually of steel) having bolt holes so that they may be made to grip the work.

In the accompanying illustrations the employment of both these useful devices is shown. A, A, are a pair of parallel strips containing the brasses, B, B, and clamping them because of the bolts, E, E. A, A, rest upon the parallel pieces, C, C, the whole being clamped to the face-plate by the bolts and plates, D, D.

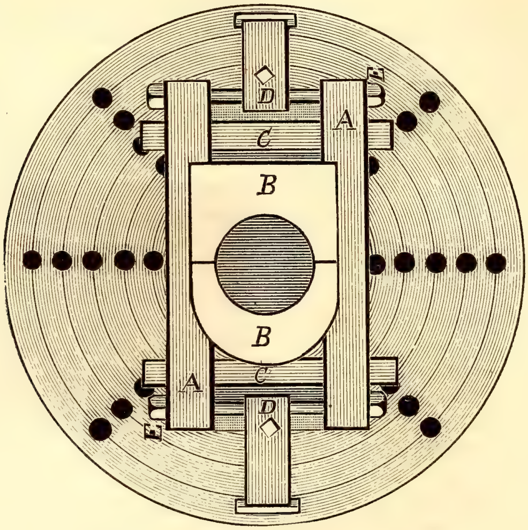

Fig. 1.

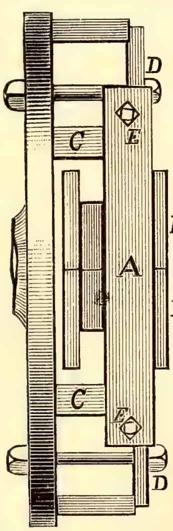

Fig. 2.

By this means the brass can be bored true to the inside faces of the flanges (which are true because they have been fitted to the strap to which they belong), which rest against the faces of A, A, the latter being kept true by the parallel pieces, C, C. The back faces of B, B are held clear of the lathe face-plate while the front faces are free and clear for turning. Care must be taken to tighten up the bolts, E, E, alternately and equal, or one brass may be gripped tighter in the strips than the other, and the latter would hence be liable to move from the pressure of the cut.

—The smallest circular-saws in use are those employed in making gold pens, and are only half an inch in diameter.

Skin Preserving.

JUST at this time of year, when the "close season" is in abeyance, and when pottering round the hedgerows for the chance of a rabbit, one occasionally meets with feathers or fur worth preserving, I have been several times asked for hints as to making up skins, till a competent stuffer, a rarity, unluckily, can be met with; and not being without experience of my own as to the difficulty of the matter, perhaps a few simple hints which may assist in overcoming the first difficulty—the *premier pas qui coute*—may be useful.

With a little practice, a bird's skin can be removed from the body as easily as that of a quadruped, and with a much more satisfactory result, as in the one case there is a thick coating of feathers which will make up for any slight deficiency in the perfection of the skin itself, while, in the latter case, the greatest possible care must be taken not to stretch the skin in the least; or a bare patch, which no amount of art will cover, will be the result. So that premising that the method of skinning is in both cases precisely the same, it will be as well to take the easier subject, the bird, on which to commence.

By "making up a skin," is understood so arranging and preserving it that a professional taxidermist will have no difficulty in softening and setting it up, after a reasonable lapse of time, while the plumage of the bird is preserved, as nearly as possible unruffled, in the ordinary position when dead.

The tools required are, I had almost said, none; but nothing more than a penknife is necessary, while a stout pair of pointed nail scissors are more handy for cleaning, and by no means cumbrous. Taking the bird as it lies, yet untouched, it is better to leave any dried blood stains to be removed after skinning. There is no advantage in cleaning at once, as after removal the feathers can be grasped from within, as well as from without, and there is less chance of stretching, the thing to be guarded against throughout, Any wet stains had better be removed at once with a bit of sponge, as they will be infinitely more troublesome when dry.

Having disposed of stains, notice where there are any wounds in the skin, for future guidance; one is very likely to increase a rent if it is unexpectedly come upon. Then take the bird by the beak, and smooth down the feathers with the free hand; placing the bird carefully on its back when every thing is in place.

The next step is to prepare the way for skinning the limbs. Taking the leg by the "knee," where the bare shank meets the feathers, and by the bone just above the joint, the leg is snapped—taking care that the pointed ends of the bone do not injure the skin—just within the commencement of the feathered portion. The same is done with the wings, and the ruffled feathers are replaced.

If the thick feathers covering the breast are now separated, a broad bare space will be found running the whole length of the body. Along this line an incision is made with the penknife, from the projecting end of the breastbone to the arms; then keeping the feathers as much as possible from the edges of the cut, though, if carefully made, there is not the least bleeding from the breast, and the special covering of the intestines is not cut through. The skin is separated with the back of the knife from the sides as far as possible, without lengthening the incision. Then carefully working down by the side of the abdomen, the legs are reached; the skin is turned back till the broken bone is found, and the muscles cut through; freeing the skin of the leg, and leaving only the broken bone end in the pocket formed by the removal of the "drumstick." The other leg is treated in the same way.

The connection of the arms with the abdomen must next be severed, and the skin turned back to the tail; the attachment of the spine to the tail severed, and then the skin of the back is carefully—for owing to the thinness of the covering here, the slightest stretch will make a woful gap in the feathers—reflected till the wings are reached. These are treated in the same manner as the legs, and then the skin is entirely removed from the body, leaving only the head and neck to be completed. The neck is cut through at its junction

with the chest, as it and the head are treated separately.

So far this sounds like a very lengthy proceeding, but, in practice, the skinning of a whole body of, say a thrush, does not occupy more than five minutes, and there should not be more than the very slightest soiling of the fingers, if any, and none whatever of the feathers. Do not throw the body away, as it will be useful in finishing.

We now come to the head, which is the hardest part of the whole operation, since any stretching here, beyond what is unavoidable, must be very carefully guarded against. And, in mentioning this, it is well to remember that the skin should be supported during the whole process as much as possible, being allowed to rest on the tables, or on the knee, which, for myself, I prefer, as the weight of the feathers alone is enough to cause an awkward stretch in the thin backskin.

The head is cleaned by turning it backwards through the skin of the neck in most birds. Some of the waterfowl though must have a special slit made below the beak, to allow the skull to be turned through, but they are very few, and it is only a modification of the usual process.

Taking hold of the end of the neck, where it was severed from the body, the skin is gradually turned back till the skull is reached. The head is then steadied by grasping the back from the outside, and the skin gently pushed back over the smooth cranium till the eyes are reached. Then, grasping the exposed skull, the eyelids are detached from the orbit, and the skin turned forward to the commencement of the beak.

This leaves the head ready for cleaning, which is generally found the hardest part of the finishing process. I find that the best and quickest way, and one which answers exceedingly well, is to insert the point of the knife into the base of the skull as far forward as possible between the two halves of the lower mandible, passing it up to the roof of the skull, and then by cutting backwards along the sides of the lower mandibles to the back of the skull, removing the tongue and the whole attachment of the neck and its organs with about one-third of the skull, allowing the contents to be removed entirely. When the eyes are next removed, the anterior two-thirds only of the skull remain attached to the beak, and the whole is perfectly cleaned.—*Science Gossip.*

To be Continued.

Editorial Notes.

Something for Young Microscopists.

FOR some time past our stock of paste eels has been exhausted, and we have been unable to send them to those who asked for them. We now have a stock on hand, so that we can supply a small quantity to any of our subscribers that wish it. Those who call at the office should bring a small bottle, or tin or wooden box with them. Those who send by mail must enclose five cents in postage stamps to pay for packing and mailing.

These eels are exceedingly interesting and curious when seen under the microscope. For the benefit of our younger readers we give the following directions for managing and showing them: As soon as you have mailed your order for the eels, prepare some flour paste, well boiled and about as thick as cream. This will be in just the right condition when the eels arrive. The eels will come in the form of a little paste, packed in a hole in a block of wood. Take the block out of its wrapper, fill the hole with thin paste, and then put the block into a cup of paste, covering it over thoroughly. In a day or two the entire surface of the paste in the cup will be a mass of living eels.

To exhibit the eels proceed thus: Skim off a little from the surface of the paste and place it on a glass slide, adding a little water. Cover it with a thin glass and examine with a half inch, two-thirds, or one inch objective. The paste will be seen to be a living mass of eels. The light should not be very intense if the best results are desired.

A slide prepared in this way and illuminated by means of the spot lens, or paraboloid, presents a most beautiful and extraordinary appearance. The living creatures seem like brilliantly self-lumin-

ous or phosphorescent objects floating in a dark sea. Those who have not a spot lens or paraboloid may still get tolerably fair results by using very oblique light—light so oblique that the objective cannot take it in except when reflected from some solid object.

Having once obtained a stock of eels they may be multiplied indefinitely, so that a single speck is enough for all the microscopists of a large town.

Postage Stamps.

WE again call the attention of our subscribers to the fact, that while we take postage stamps of small denominations at full value, those of higher denominations are of no use whatever to us. We cannot sell them, except at a very great loss, and the post office will not exchange them for smaller denominations. Therefore, please do not send them.

Astronomy for Amateurs.

BY BERLIN H. WRIGHT.

(Calculated for the Latitude of New York City.)

THE PLANETS—APRIL, 1880.

	D.	H.	M.	
Mercury rises	26	4	15	morning
" "	29	4	12	"
Venus "	5	4	48	"
" "	20	4	30	"
" "	30	4	20	"
Mars sets	6	0	24	"
" "	25	11	52	evening
Jupiter rises	10	4	51	morning
" "	30	3	45	"
Saturn "	10	(*Invisible.*)		
" rises	30	4	26	"
Uranus in Meridian	10	9	11	evening
" "	30	7	51	"
Neptune	(*Invisible.*)			

NEAR APPROACH OF THE MOON TO STARS AND PLANETS, ETC.

April 1. Moon 2° N. of bowl of "Milk Maid's Dipper.
" 6. " 20° S. of Great Square of Pegasus.
" 8. Jupiter 6° S. of Moon.
" 8. Saturn Conj. Sun—*invisible.*
" 8. Venus 7° S. of Moon
" 11. Neptune 6° S. "
" 12. Moon 5° S. of Pleiades.
" 13. " between Pleiades and Hyades.
" 14. " Apogee and Highest.
Apr. 14. " 5° S. of β Aurigæ, and nearly midway between Betelguese and Capella.
" 15. Mercury *very close* to Venus.
" 15. Mars 1° North of Moon.
" 15. Venus very close to Jupiter.
" 15. Moon 10° in Gemini: 20° S.W. of Castor and Pollux, forming an isosceles triangle.
" 16. " between Pollux and Procyon.
" 18. Jupiter very near Mercury.
" 19. Moon 4° South of Regulus.
" 20. Uranus 5° N. of Moon.
" 23. Moon very close to Spica.
" 26. Mercury gr. elon. W. 27°.
" 26. Moon Perigee.
" 27. " lowest.

THE MOON.—I.

The naked eye will show the freckled appearance of the Moon, and the smallest telescopes the numerous irregularities upon her surface. The observer must not think to make out the details at first; the eye must be practiced for the work. Neither should you expect to find a prototype of the earth, for our neighbor has no atmosphere. Hence, the denuding action of air and water are not at work there, and we see the lunar peaks in all of their primitive sharpness and ugliness, and as one gazes upon the scene, with a high power, the thought that we are gazing upon the scenes of gigantic convulsions, which must have shook that small body to its centre, cannot be repressed.

The following is the nomenclature of the Geography of the Moon: Mountains, Hills and Ridges; Gray Plains or Seas; Crater Mountains, composed of three classes—Walled or Bulwark, Plains, Ring Mountains and Craters; Valleys and Canals, or Rills.

Although a micrometer is not essential for interesting work, its use will add much to the pleasure of observing. One properly ruled into 60ths or 100ths of an inch may be procured of opticians for about $2.00. Insert it in the eye-piece, and it will be a simple matter to verify any of the figures which we shall give, and make independent measurements. Knowing the diameter of the Moon in miles, count the number of spaces required to make the diameter, then take such a part of the Moon's diameter as the spaces required to cover the object to be measured is of the entire number in the Moon's diameter.

The Grey Plains are known by the following names also: Sea, Mare, Lacus, Palus, Sinus and Ocean. The first one that we call attention to is *Mare Crisum* (A on the map). This is situated in the first or N.W. quadrant, and is best seen about 5 days after New Moon or 3 days after

Full Moon, or about the 14th and 27th of April. Mare Crisum may be seen with the naked eye as a dull greyish patch. With the telescope it appears oblong with a brighter ring. On the 27th the northern horn of the crescent partially intersects it, and is partially covered with the shadows of the high mountains upon the north-east side, some of which are estimated to be 16,000 or 17,000 feet high. This vast plain is believed to be a "dry flat," analagous to our deserts.

Mare Crisum is 280 miles from N. to S., 354 from E. to W., and contains 14,260 square miles, or 1-111th of the Moon's visible hemisphere. By some observers it is thought to contain a trace of green, possibly, though not probably, due to periodical vegetation. The surface is more deeply depressed than that of Mare Fœcunditatis (X) or Mare Tranquillatatis (G). Some of its boundary mountains are very steep and high. Promontorium Agarum (1) rises 11,000 feet, and the peak S.E. of Picard (4) 15,600 feet. The last-named *crater* is within Mare Crisum, as will be seen, and it is recorded by some observers that regular, white ridges, like walls, are just South of Picard.

Near the E. edge a low spot may be seen in the surrounding ridge, forming a pass, and near it are several mountains, some quite lofty. Some observers believe that they have noticed changes in these. The craters in this district seem to lack the little central hills so common in the others.

A strange story is told of an observation made on this sea by a pupil of the astronomer, Lambert; it is as follows: The night was perfectly clear, and with a common 4 feet refractor he saw four bright spots in Mare Crisum, two of which are now known. After noticing them for two hours he found, all at once, that the part of the terminator, or horn of the crescent, in M. Crisum, had a slow reciprocating motion, oscillating between the pairs of black spots in five or six minutes. The same phenomenon was observed with larger and smaller telescopes. A similar occurrence has been noticed in the case of Jupiter's satellites, during transit, and with stars when about to be occulted by the Moon. It seems to be some kind of an optical illusion which has never been satisfactorily explained.

Penn Yan, N. Y.

On Drills and Drilling.

THE attention of many professional men and others interested in mechanical operations has for a lengthened period been directed to this subject. As must be well known, there are a great many descriptions of drills now in use—some good some indifferent. The American twist-drills are now sold in large quanties, and for some purposes answer exceedingly well; but at the same time there are points to be reckoned against them. Firstly, it is very difficult to grind both edges at the same angle, and if this is not done, the result will be that the hole will not be the true size of the drill used; this will deceive a workman, and may probably spoil good work. And another objection to them is, that when the drill is about to come through the hole being bored, the quick twist causes it to worm through at such a speed that, in many cases, the drill is either broken, or the work forced up to the end of the twist, thus spoiling what might otherwise have been a smooth hole. We consider that the best description now in use is the straight fluted drill, which was originally introduced by a Mr. Martin, of Charlton; but this gentleman having for some long time ceased to make them, there arose a difficulty in procuring them. They are now, however, to be had more readily, and a set of these drills should certainly be found amongst the tools in every workshop.

With all the improvements that have from time to time been introduced in the various drills, in most factories, we have frequently noticed, that except for very large work, every workman prefers to make his own drills, and from personal experience we have found no better drills than those thus made, to do which is a simple process. For example, a drill-chuck being fitted to the lathe, with a round hole ¼ in. in diameter, and a fixing-screw; have always at hand a bar of round cast steel of the correct diameter, to fit the hole, and cut off a length as required. If the drill is to be made of a large diameter, it must be flattened out at the forge to the desired size, and then finished with a file. Most workmen, nowadays, simply forge their drills and grind them into shape; this answers every purpose for work that does not require any finish, all that is necessary is that the tool should run pretty true in the lathe and cut well. In boring a hole in thin work it becomes necessary to make it flat at the bottom. To do this a small half-round bit placed in the same chuck answers the purpose. This is essential where the hole has to be topped, as it allows of one or two more threads being made by the top. If the drill is required to be smaller in diameter than the steel from which it is made, it is a simple matter to turn down the end and then file it flat on both sides, to the same shape as the larger one previously mentioned. A great point with regard to drilling is the hardening of the drills. The old-fashioned cylinder-bit for finishing a long hole is as good as any. To

make this the circular part must be turned all over, and the cutting end filed down for about half an inch from the end. But we think the before-mentioned cylinder straight-fluted drills supersede them. In using all these drills for boring a hole between the centres of the lathe, it is a most essential thing to let the work turn round occasionally in the hand. A certain way of boring a true hole of large diameter, say ¾ to 1 inch is to fix in the chuck a well-made cylinder-bit, and carefully fix the work on the saddle of a self-acting lathe, and place on the change-wheel used for a fine finishing cut. * * * For very small work the bow drill is a most useful tool. Bows are made in many ways, and from different materials. Those for sale are of steel, with a hook at the end, over which a thin catgut is looped, with another hook near the handle, and to alter the tension a small toothed wheel with a detent is used. * * The Archimedian drill is also used for many small pieces of work. This is made from pinion-wire carefully twisted into the form of a very quick screw; and to tap the nut for it a similar short piece must be made and the end tapered off to the bottom as if were of the thread. This done a hole must be drilled in the piece of metal that is to form the nut, and the tap, as we will call it, be driven through it. This will form a corresponding screw for the long one to work in. * * * To know how such a thread is put into a piece of metal may be of service for other purposes.—*Forge and Lathe.*

Polishing and Finishing Metals.

We now come to the means adopted for finishing and polishing steel and iron. Take, for instance, a surface of steel as an example—the square stem of a drilling instrument will form a very good subject. After it is roughed out, and the work all done, it must be draw-filed, and this must be done with a superfine Lancashire file, and the lines must be kept quite straight, otherwise it will require so much emery-paper that the edges will lose the sharp angles which are the beauty of the work. Any ordinary workman can rub away with emery-paper, but in so doing he may spoil the appearance of a piece of good work, and that without knowing it. To avoid this, the smoother and better it is filed the less paper will it require. To get the beautiful finish we see on the best work, a piece of flour emery-paper, well worn, and a little oil upon it, will be found the best thing to use, and when this has been well worked, to get the high polish, a piece of wood flat upon the surface, with some fine crocus, will bring it up to this state; and if any deep scratches be there, you will at once observe them, and to remove them, in all probability, it will have to be filed all over again. Now, to avoid all this loss of time, great care must be taken that the scratches are removed before any attempt is made to polish. Having finished the work so far, many prefer to see it left straight; others, again, like to see it in some way ornamented. Now, there are several ways of doing this. First, then to cross the surface. This is done by folding a piece of emery-paper tightly round a file, but the process is not the merely pushing it across the work and making a mark, but it requires some practice to produce a good pattern, and the wrist must take a kind of circular action, and by doing this each line becomes, so to speak, connected, and makes a much better finish than a series of lines only. Another process of finishing steel is to curl all over the surface with a piece of oil-stone that will cut. This is a most difficult thing to obtain, as very few stones will cut steel to leave the bright marks necessary to give it the appearance desired. When a piece of this is once obtained it is really a prize, and if it wears away it may be inserted as far as possible into a wooden handle. To use the stone when it is once obtained is the next thing. This is done by holding it firmly in the hand and moving it about in all directions, like curling brass. There is no stated number or size of the curl, but this is quite a matter of taste, and must be left to the operator. Another way of finishing iron and steel is with the scraper, which is used with both hands, and the work must be scraped in various directions, but with regularity. Large surfaces are sometimes done in this way. Lathe-beds are at times done so, but we think this is somewhat out of character, as the fact of continually drawing the poppit-head up and down the bed produces a series of lines which look most unsightly. Regarding all this, it is all a matter of taste, and the style of finish must be left to the operator.—*Forge and Lathe.*

Practical Hints.

Rat Pie.—The Rev. J. G. Wood, the well-known English naturalist, in a lecture the other day said that there was literally nothing of which he (the lecturer) was so fond as a rat pie. This was a dish which frequently made its appearance on his table, and was enjoyed by all his family. He had several friends, too, who, as he had, had overcome their prejudice, and thoroughly enjoyed a good helping of rat pie.

Paste for Mounting Photographs.—Mix throughly 630 grains of the finest Bermuda arrowroot with 375 grains of cold water in a capsule, with a spoon or brush; then add 10½ ounces of water and 60 grains of gelatin in fine shreds.

Boil, with stirring, for five minutes, or until the liquid becomes clear, and when cold stir in well 375 grains of alcohol and five or six drops of pure carbolic acid. Keep in well-closed vessels, and before using it work up a portion with a brush in a dish.

Lark Food.—The following mixture forms a very excellent food for soft billed birds, such as larks: Hemp seed, 3 parts; Zwieback (toasted wheat bread) 2 parts; Maw-seed, 1 part; Ox-heart, 1 part.

Boil the ox-heart well in water, then cut it small, and dry it in an oven till perfectly crisp. All the ingredients must then be thoroughly mixed and ground to a course powder in a mill. This is sold by dealers, as food for mocking birds, larks, and others.

For Painting, Graining and Varnishing Pine Wood.—Boil 1 lb. of logwood in two quarts of water two hours, brush this decoction well over the box—this is mahogany color. Rosewood serve the same way, but next well streak the surface, to imitate the grain of rosewood, with the following mixture: ¼ oz. green copperas in water; apply with a hard brush or fine comb; when dry, paper gently to avoid rubbing out the color, then varnish it with brown hard varnish, using a camel hair brush. If care be taken and neatly done, it will have a good effect.

To Remove Nitrate of Silver Stains.—Dr. Kraetzer, of Leipzig, proposes, as a substitute for potassium cyanide in removing stains made by nitrate of silver, the following: Ammonium chloride, 10 grams; corrosive sublimate, 10 grams; distilled water, 100 grams. Preserve in a glass-stoppered bottle. He says that with this solution the black stains may be removed from linen, cotton, and woolen goods, without injury of the fabric. It will also remove these stains from the skin, but although it is less poisonous than the cyanide, it is a corrosive poison.

The Metric System in Coins.—It may not be generally known that we have, in the nickel five-cent piece of our coinage, a key to the tables of the linear measures and weights of the metric system. The diameter of this coin is 2 centimetres. and its weight is 5 grams. Five of them placed in a row will, of course, give the length of the decimetre; and two of them will weigh a dekagram. As the litre is a cubic decimetre, the key to the measure of length is also the key to measures of capacity. Any person, therefore, who is fortunate enough to own a five-cent nickel may be said to carry in his pocket the entire metric system of weights and measures.

Magic Polishing Cloths.—For some time past there have been sold in Europe, as polishing cloths, square pieces of calico, with which metallic articles could be polished and cleaned without the intervention of other substances. They were simply impregnated with a mixture of soap and tripoli, and tinted with coralline or rouge. For a piece of fabric 30 inches long and 4 inches wide, the following quantities are sufficient: Tripoli, 2 grams (30 grs.); castile soap, 4 grams (60 grs.); water, 20 grams (300 grs.) The soap is dissolved in the water, the tripoli added, and a little solution of coralline added to impart a rose color. The fabric is then thoroughly impregnated with the mixture and dried.

Lubricators.—The efficiency of lathes, scroll saws, sewing machines, and even watches, often depends upon the judgment and care used in selecting a lubricator, and this choice is frequently ill made. Common kerosene oil is too often injudiciously used in place of a thicker or more bland oil, because the heat produced by friction rapidly vaporizes the oil and leaves the journal dry. Crude petroleum for the same reason is fitted only for very slowly-revolving journals, such as water wheels. For very heavy machinery, or for gearing, tallow and black lead rubbed up together is the best lubricant, and is also the best for wagon and carriage axles during the hot weather. For light-running machinery sperm oil is the best; good olive oil that has not become rancid and acid, is perhaps the second best, and for winter use lard oil is excellent, but is rather too drying to be a first-class lubricant. Castor oil is better for axles in the winter, and black lead with it is a help at any time.

EXCHANGES.

To exchange, $5 pair of telephones for mounted microscopic specimens, good objective, lathe chuck, watch, type and cases, or offers; describe offers. Wm. R. Brooks, Phelps, N. Y.

What offers for Roger Scroll Saw, 55 large patterns. J. Brower, 3,150 Frankford Road, Philadelphia, Pa.

Revolver, microscope, microphone, 4 magnets, skates, skate sharpener, copying pad, books, magazines, $7 worth of rosettes, and lots of other things to exchange; I will give you a better trade than anyone else can. Chas. T. Conover, Esperance, Scho. Co., N. Y.

Photographs of ten of the most influential Indians of Spotted Tail Agency, including Spotted Tail and family and four oil chromos, very beautiful, for printing press, scroll saw, or offers. Luther Emerson, Creighton, Knox Co., Neb.

"Appleton's Picturesque America," never been read or handled, value $24; "Dana's Mineralogy," $10, and coins, to exchange for a breech-loading shot gun, Winchester or Evan's rifle, or offers. D. M. Fuller, Box 115, Camden, Maine.

Scroll sawing outfit, $6; microscope, $3; pocket telescope, $1; Gaskel's Compendium, $1; Williams' Complete Painters' Guide, $2. What offers for all or part; printing outfit preferred. F. W. McNair, Box 46, Fennimore, Wis.

$7 worth of books or papers, to exchange for a Household microscope or offers. Jonas D. Rice, 221 Academy St., Mercer Co., N. J.

One pair best steel climbing irons, handsome seven shot, 22 calibre revolver, full nickel plate, ten dollars worth of boys' papers, and magazines, for works on natural sciences or offers. W. M. Stribling, Circleville, Pickaway Co., Ohio.

Will exchange phantom leaves or fern roots (maiden hair included), for sea mosses, shells or petrifactions. E. M., New Boston, Mercer Co., Ill.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

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Lessons in Magic.—X.

TRAVELLERS returning from the East bring with them such wonderful stories of the marvels performed by the Indian Conjurers, that those gentlemen are looked upon by many as real miracle-workers. There is no doubt, however, that there are many persons at home equally as clever as the copper-colored jugglers, and, in all probability, far more so.

Be this as it may, a favorite announcement among professional conjurers is "An Oriental Programme," and they have often endeavored to present similar tricks to those narrated by the newspaper "special correspondent in the East."

Among the most successful of these magicians who, "having just returned from India, where, after many years of research and travel," etc., etc., was the person who appeared in London some years ago, under the name of Colonel Stodare.

As it was rather unusual to find a Colonel in the British army in the role of a magician, he drew houses crowded with the best people of the city.

Of course he had never held a commission in the army, and was, in fact, a son of old John Henry Anderson, the Wizard of the North, but this fact was not known, and his little hall was nightly filled with an audience, amongst which was no slight sprinkling of scarred veterans, genuine generals, colonels, and what not.

One night a little knot of these officers got together, and, when the performance was over, remained in the hall, determined to have a chat with Stodare. As he was about to leave one of them addressed him:

"Good evening, Colonel."

"Good evening, sir."

"Pray, Colonel, what was your regiment?"

"I beg pardon, my regiment? Really, I do not understand you."

"Don't understand me? My question is plain enough. To what regiment were you attached? You style yourself 'Colonel,' and surely you must have had a regiment."

"O, I see now. Bless my soul, a very curious mistake that, very curious. The fact is, however, I have never been in the army. 'Colonel' is simply my Christian name, as your's may be Thomas or Richard."

The inquirer, who was a genuine "colonel," apologized, laughed at the mistake, and told it at his Club as a good joke, never suspecting that the "Christian name" was a device for drawing houses, and as much Stodare's name as mine is Hannibal.

With Stodare as a "colonel" we have nothing to; it is with his tricks only that we have to deal, and they are very clever. His was, essentially, an "Eastern programme," and introduced the "'Famous Indian Basket Trick,' and 'Miraculous Growth of Flowers,' as performed only by the Indian jugglers and Colonel Stodare."

The "Basket Trick" was really startling as the "Colonel" presented it, but is suited only for the stage. But as the late Robert Heller also exhibited it, and many of our "Young Scientists" may have seen it and feel curious to know how it is done, I shall explain it for their benefit.

A wicker basket, sufficiently large to hold a grown person, is brought on the stage, turned over and opened so that the audience may see that it is not only empty, but has a solid bottom, without traps or opening of any kind.

A young lady is then introduced, and after being blindfolded, the performer proceeds to explain what he is about to do.

"I propose, ladies and gentlemen," he says, "to place this young lady in that basket, which, as you see, stands on an open platform. After she is inside I will take a sword, which, I assure you, is without preparation of any kind, and pass it through the basket in such a way that it must inflict some wounds on the girl. She can not escape as I will fasten down the cover, and if she succeeds in getting out at the bottom you will see her, and I feel sure will let me know, otherwise it would be the means of spoiling the trick."

Whilst this explanation is being made, the young girl quietly walks off the stage, and it is not until the performer turns to assist her in getting into the basket that he discovers she is gone.

He immediately rushes off the stage, but returns in a moment leading in the girl again, and with a drawn sword in his hand. He bids her stand where she is whilst he goes down to the audience to show the sword. As he returns to the stage he remarks, "I hope you feel satisfied, ladies and gentlemen, that this is a genuine sword, but if any of you doubt it I think you will cease to do so when I begin the slaughter of this fair maiden."

At these words the girl screams and runs off the stage for a second time; the performer places the sword on a chair, goes after her again, and immediately returns, dragging her with him. Despite her struggles he forces her into the basket, and seizing the sword thrusts it into it. Screams of agony are heard, and blood is seen issuing from between the willow strands. After a while these screams become fainter and fainter, and then cease altogether.

The performer and his assistant turn over the basket and open it, so that the audience can see inside, and to the amazement of everyone it is empty. At the same moment the young lady walks up the aisle of the hall, mounts the stage, smiles, and courtesies to the bewildered audience.

Although the trick in this shape is comparatively new, the basket for it is made after a very old pattern, having been used in pantomines for many years under the technical name of a "harlequin-box." I do not know who was the inventor of this ingenious box, but am inclined to give the credit of it to the Chinese, as I have often seen the jugglers in their country use it.

The basket is made with four sides and a lid, but no bottom. The depth and width are of the same measurement. The bottom is made of wood, or rather the bottoms are, for there are two, equal in size, and joined together at one edge so as

to form an angle. When these are fitted to the wicker basket, the one marked A forms a bottom for it, whilst B fits closely to the inside of that part that faces the audience, making a sort of false side. Having been fastened in the lower front corners by large pins, that will allow it to work freely, the apparatus is complete.

When the performer wishes to show the audience the inside of the basket he turns it over. In this position they see the whole interior and one side of B, which *was* the false side, but now appears to be the bottom.

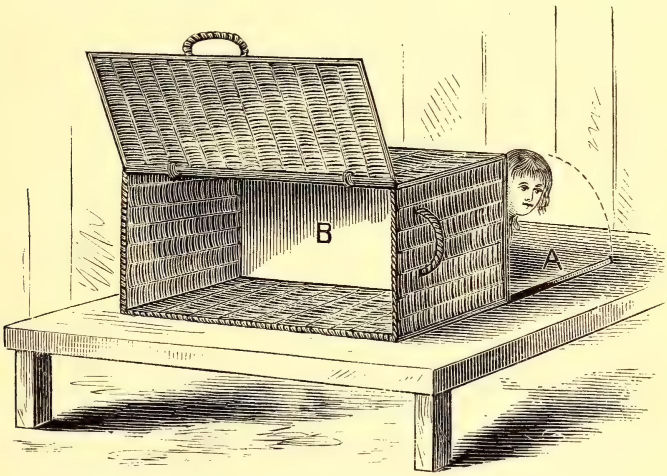
Supposing a person is in the basket and the performer wishes to show it to be empty. The man who is inside sits still and the performer turns over the basket; by this movement the person who was inside is brought *outside*, but is hidden by the basket, *behind* which he is now actually lying.

The basket being provided, there yet remains three other necessary things before the trick can be performed. The first is a stand about a foot high, of the same length as the basket and a little more than double the width. The second is a young girl of prepossessing appearance, and the third is *a second* young girl of equally prepossessing appearance, and as near like the other as possible. The features need not be the same, as the handkerchief used in blindfolding hides those.

When the first girl is brought on the stage the performer delays blindfolding her, so that the audience may get a good look at her and become familiar with her face. When she runs out she is brought back again, but when she runs out the second time the other girl is dragged on in her place, and being immediately forced into the basket the audience do not have time to notice the change.

In arranging the basket it must be placed far enough back on the stage to prevent those who are sitting at the sides from seeing behind it, or else they will discover the girl. This may be prevented in a great measure, however, by arranging chairs and stands at the ends, as if for your own convenience, for instance: at one end a stand with drapery falling to the ground may be stood to hold the sword, whilst at the other a similar stand and a small footstool may be placed as if for steps leading to the basket.

The blood which flows from between the crevices is caused by the girl who is inside squeezing a sponge filled with any good red fluid.



THE BASKET TRICK.

Drawing Lessons.—VI.

BY JOHN CLARK CENTER.

Figure Drawing.

WHERE it can be procured, a plaster cast of the human form or part of it makes the best lay figure. The materials required for drawing are a few pieces of charcoal, Nos. 1 and 2 black chalk, a leather stump, a port-crayon, and some regular crayon paper, slightly tinted, as this takes the chalk best.

The light should be allowed to fall on the sketch from the left hand. The pupil should sit with his head thrown back from his drawing as far as possible, in order to catch the proper effects of the parts sketched. A correct outline of the subject should first be drawn with the charcoal, which is easily dusted away by a very soft handkerchief: this is better than rubbing out, as friction destroys the surface of the paper.

After a correct outline is obtained, trace with the black chalk as faintly as possible, when the chalk can be dusted away with the handkerchief, which will leave a beautiful clear outline; after which he may begin the shading.

Scrape a little of the chalk as fine as possible on a paper, rub the stump amongst the powder. Taking this, rub in the shadows—these will, by proper care, be soft and beautiful, and will furnish a good ground for the finish.

Having carefully studied the different strengths of the shadows and the roundings they produce, with a fine point on his chalk let the details be put in. He should patch over all the shading with this fine point. This, when done with proper care and skill, gives a very beautiful effect. In shading, the pupil must observe that there are two kinds of shadows; one is called the shadow of incidence, the other the shadow of projection. The first is always soft, having no defined edge, but softening imperceptibly into the light. The shadow of projection is always defined, having a sharp, decided edge. Avoid all hardness of edge, as the deepest shadows are always nearest the highest lights. If any mistakes are to be corrected or greater softness be required in any of the parts, a little stale bread will remove the chalk, and by careful application a very beautiful effect can be produced in subduing and blending the different shadows.

This treatment of chalk as a medium for drawing is that used by schools of art, and can be studied in the crayon portraits of your friends, and other works of art of a similar character.

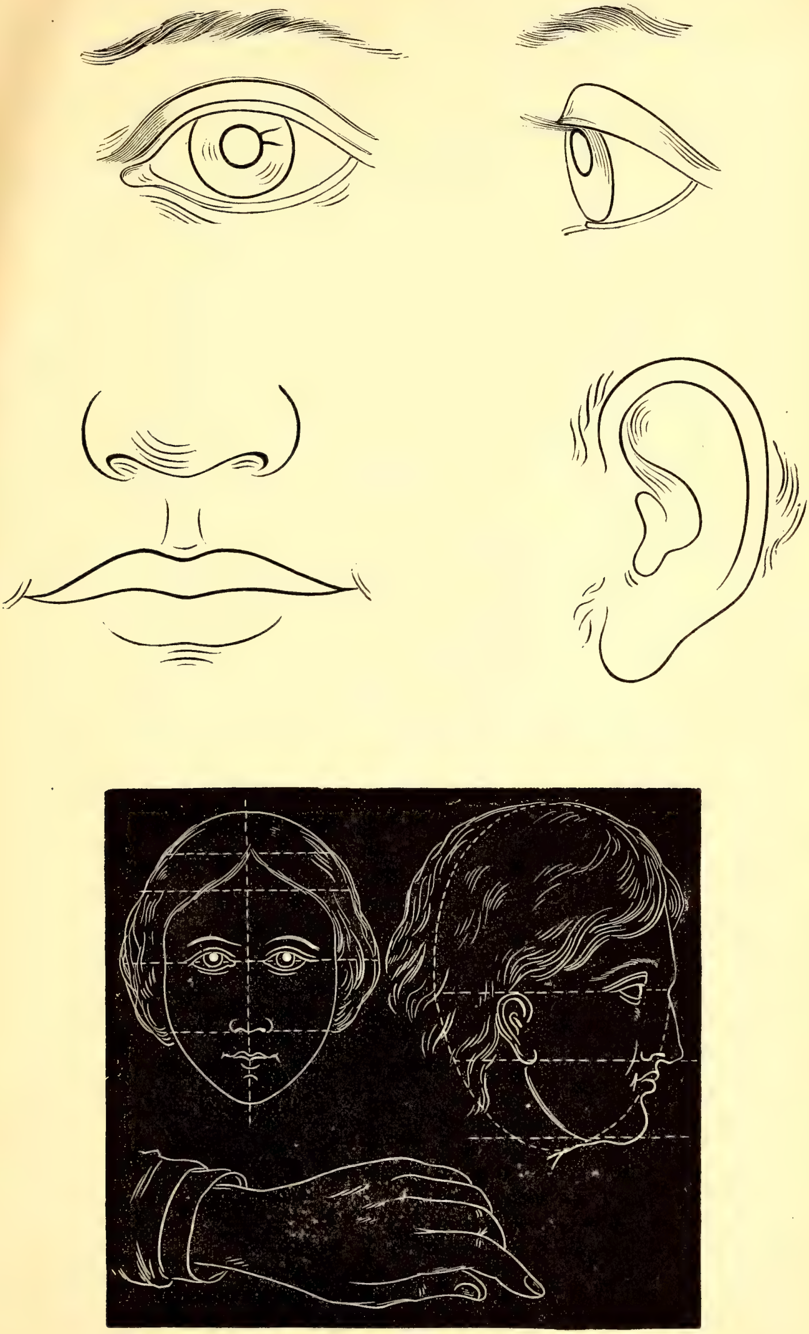
We would recommend those who have models, of whatever kind, to practice this method of shadowing in drawing them; and when they attempt to draw the human "head divine," or other parts of the body attached to "that head," each part of which is a study in itself, or the clothing or draperies which may cover or surround it, demands will be made on manipulative ability for the treatment of each, and the textures will call for experiments until the desired goal of perfection is reached and the "prize is won."

In closing these lessons we will present in the accompanying illustrations the proportions which different parts of the human frame bear to each other, according to the acknowledged standard of beauty, as derived from measurements from the antique. These will be of great assistance in drawing from casts. We must not suppose that beauty is so much dependent on these rules as upon correctness. There are many styles of beauty, the different styles often resulting from the slightest deviation in some point or other from established proportions.

The mouth, in width, is equal to the length of one eye and a half, in profile it is exactly the same height, but only half this width; the upper lip projects less than the lower one.

The nose, in width, is equal to one eye, and in height to two from the eyebrows.

The eye is composed of the ball, the sight, the lachrymal point (which is the point nearest the nose), the upper and lower eyelids, and the eyebrow. The ball, when seen in front, is an exact circle, with the sight in the centre. The height is equal to half the length, and the eyebrow is situated above the eyelid about one-third the length of the eye. In profile it is the same height, half the length as



ELEMENTS OF FIGURE DRAWING.

seen in front. The eyeball forms an ellipse, with the sight always in the centre.

The ear, in width, is equal to one eye, in length to two. The hand is the same length as the face, in width one-half. The foot, in profile, is nine eyes in length and three in height.

The proportionate height of a man is ten faces; and extending the arms horizontally their full length the same proportion is obtained.

These measurements are only suggestive of some of the more important proportions of the human body which the student of art and truth must master.

Home-Made Telescopes and Microscopes.—IV.

THE POWDERS EMPLOYED FOR GRINDING AND POLISHING GLASS.

SUCCESS in producing well-finished lenses will depend a good deal upon the excellence of the grinding and polishing powders used. In regard to this point Mr. Wenham gives the following directions:

"For lenses, emery is almost invariably employed for rough grinding and smoothing. For the latter operation it must be washed to various degrees of fineness, as it is seldom sold in this state; the sizes in commerce are merely sifted. Emery differs much in hardness and quality, according to the locality from which the ore is obtained. If it is full of small reddish particles, of a dull slaty appearance, it is soft, and deficient in the grinding property. The Guernsey emery is of this character, and very inferior to the Naxos, the particles of which have a steely appearance of uniform color; but this latter is difficult to obtain, as it is monopolised by some of the large plate-glass manufacturers. Three or four sizes are sufficient for the glass worker for roughing down and fine grinding; but for smoothing, washed emery of several degrees of fineness are required. A portion of the flour of emery of commerce is placed in a bowl, or a common wash-hand basin, and well stirred up. At the end of ten seconds the water is poured into another bowl; this is repeated several times, till no more can be withheld from the original quantity. This washed quantity is again separated into several other degrees of fineness, as at the end of one minute, five, twenty, and sixty minutes; but, after one hour, a very small quantity is obtained from one pound of the flour of commerce. This being of value for the perfection of the final smoothing, or obtaining a semi-polish on the metal lap or mould itself, I have preferred procuring it from the "optician's mud," or refuse of the previous grinding operations. Taken in an unprepared state, this contains a large percentage of impurities, consisting of ground glass and metal particles from the laps; it is, therefore, necessary to remove them. The first by boiling the mud with caustic potash, and after washing away all trace of the alkali, finally treating with dilute sulphuric acid. The finest portion only of one hour's suspension may then be separated and in a satisfactory quantity.

"The polishing powders used by the workers of minute lenses, are putty-powder, or oxide of tin, and crocus, or peroxide of iron. The first may be obtained sufficiently good without any difficulty; but after many trials, both by roasting the alkaline precipitate from sulphate of iron, and also carefully washing the crocus of commerce, I have given the preference to jeweller's rouge. In this form it is far too soft for glass polishing; it must, therefore, be heated in an iron pot, and dilligently stirred till the mass acquires a purple color; it is then of the requisite degree of hardness. Both this and the putty-powder must be washed, to separate gritty particles; about five minutes will be sufficient. After obtaining all that can be suspended in this time, the residue may be levigated on an iron plate, with a soft iron spatula, and the washing continued at pleasure; but the result of all the washings is sure to contain some gritty particles, which must be separated by repeated washings till nothing whatever will settle at the end of five minutes. Two sizes of crocus only are needed; the last is obtained from the washed mass after one hour's suspension, and is very small in quantity but of much

value for obtaining the finest polish on prism work, either in glass or calc spar. The ordinary washed crocus, used alone, I have found too keen, and apt to cling to and raise streaks on the polishing laps; I, therefore, always mix it with an equal part of the putty-powder, which quite remedies the evil; an uniform mixture is best obtained by stirring them together with water."

Skin Preserving.—II.

(Continued.)

THE skin is now ready for making up. Of course some preservative composition is a desideratum; and the best is the time-honored arsenical soap. That which I have used, and which answers perfectly, is made of one ounce of white arsenic to four ounces of yellow soap. The soap is first shredded into a pot; and melted by being stood in hot water; and the arsenic stirred in gradually, then allowed to cool; covered, and a poison label affixed. But in case there are nothing but the ordinary household stores available, skins will keep very well, and for an indefinite time if the moth be kept from them, by curing with equal parts of alum and salt. This is rubbed into the skin extended on a board, and allowed to dry; after which the superfluous crystals are brushed away. This, however, has disadvantages, owing to the hard coating given to the skin, but for curing skins not meant for further stuffing than sufficient to retain their form, is quite satisfactory.

We now come to the final making up; and here the materials required are again simple; the preservative, tow, a needle and cotton, stout thread, and the scissors. The first step is to examine the skin, and remove any superfluous fat which may have been left attached; and to see that no portions of muscle remain on the broken ends of the limb bones; in doing which the preservative is well rubbed over the interior of the pouch formed by the skin of the legs and wings. Before returning the ends of the bones into the sheath, a shred of tow is wrapped round the end of the bone, and then formed into a pad as nearly as possible the size of the removed portion which still remains attached to the body, and the limbs will require no further treatment.

The whole of the skull, inside and out, is now treated with preservative, and the orbits filled with tow to as nearly as possible the natural amount of fulness given by the eyes when in their place—and the back of the skull is replaced by a ball of tow rolled up tightly, so as to fit the interior and give the requisite roundness lost by the removal of the hinder third in cleaning. The head is then gently returned through the "glove finger" formed by the neck, and any sinking about the eyes rectified by inserting more scraps of tow through the eyelids. The neck is then filled by gently passing up shreds of tow by means of a stick, taking care not to overfill it, or leave lumps of tow evident by their undue protrusion.

It is better, at this stage, to bring together any small gaps in the skin caused by shot or accident during skinning, by means of the needle and cotton, avoiding the rumpling of plumage, which would be caused by including the root-ends of feathers in a stitch.

There only remains now to pad the body to prevent undue shrinking during the drying stage. This may be done either by merely filling up with loose tow, folding the skin over and allowing it to dry in position, or by making a fresh body of tow to replace the natural one as nearly as possible; and this latter method is, I think, the better.

Taking the body, which has been kept as the model, a lump of tow is rolled into a compact ball, rather larger than the required size, and of the same proportions. The strong thread is then wound around it tightly, reducing it to the right size, and, with a little management, giving a pretty correct model of the contour of the breast, etc. If anything, when completed, the tow body should be smaller than the natural one, to allow for the unavoidable shrinking of the drying skin. It is then placed in position, and the skin of the breast brought together evenly across it by a few stitches in the edges of the bare streak along which the first cut was made. Holding the skin by the beak, the feathers are carefully smoothed down, and returned

to their natural positions. There will be no difficulty in the pose of the wings, which, unless stretched, will fall perfectly naturally into their places. The skin should be laid carefully on its back on a flat surface, in the same position as when held by the beak, securing the wings, if necessary, by a thread passing round the body, and left untouched till dry, which will take a longer or shorter period, according to the size of the specimen, and the state of the weather. Occasionally during drying there will be a tendency of some few feathers to become prominent, owing to contraction; if they are few, they may be removed when the skin is dry; but in the case of a tuft of plumage, they must be kept down, either by a weight or by a strip of paper crossing them and pinned through the skin to the tow body; but, unless the body is overstuffed, there should be no difficulty as to smoothness of feathers. Perhaps the thick tuft covering the shoulders is most prone to rebel, and I have often found it useful to surround the wings with a broad strip of paper, secured by one pin through the breast, instead of the thread.—*Science Gossip.*

To be Continued.

How Plants Breathe.

IN a former article we described the manner in which insects breathe, and gave a cut of the spiracles or openings through which the circulating system of the insect communicates with the air. We now give a description of the way in which plants breathe.

The breathing of plants, if it may be so called, is, however, just the opposite of the breathing of animals. The animal requires oxygen, which burns up the used-up tissues of the body and makes heat to keep that body warm. The product of this combustion, carbonic acid, is then thrown off, and this carbonic acid, which would be poison to animals if again breathed, is the breath of life to plants, for they decompose it, use the carbon for the purpose of building up their tissues, and give off the oxygen, which again becomes the breath of animals. In this way plants and animals form a mutual balance, each supplying what the other needs, and consuming that which the other throws off.

If we take the fruit leaves of almost any plant, and strip off a little of the cuticle or thin outer skin, we will find that under the microscope it presents an appearance somewhat like Fig. 1. All over the surface will be seen the stomata or openings, five of which are shown in the engraving.

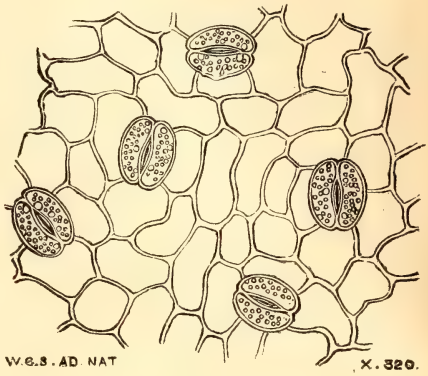


Fig. 1.

In some plants, such as the *Hydrangea*, there are 160,000 of these openings to every square inch. In other plants there are fewer; thus the *Yucca* has 40,000, and the *Iris Germanica* 12,000. The best way to procure the cuticle for examination is to take a very sharp knife, cut the cuticle across, raising it a little at the same time, and then, grasping it between the thumb and the edge of the knife, strip it off by gently pulling it. There is a knack about this which is more easily shown than described, but a very few trials will enable the young microscopist to succeed, and then he will have a wide range of subjects from which he may select beautiful objects for his cabinet. In a future article we will explain the best methods of mounting them.

In Figure 1 the stomata are shown as they appear when seen from above. The way in which they open into the interior of the leaf can only be shown by a cross-section of the leaf, such as is shown in Fig. 2. Such a section is easily obtained by fastening a leaf between two pieces of

carrot, and shaving off very thin slices with a razor. The razor must be sharp and should be kept well moistened with a little water, to which a small quantity of alcohol has been added. The thin slices, or sections, as they are called, are floated off into a basin of water, whence they are lifted out, placed on a slide, covered with

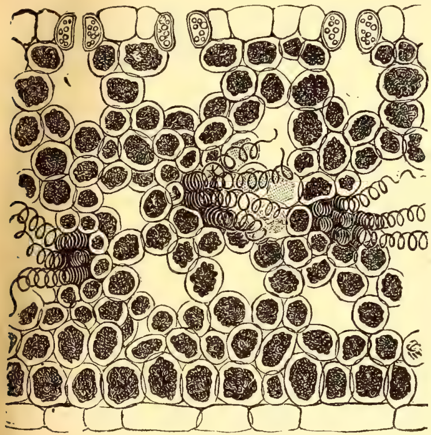


Fig. 2.

thin glass and examined under the microscope. The openings from the interior of the leaf to the outer air through the stomata will then be readily seen.

In cutting these sections the leaf and its supporting carrot may be held in the hand, but this requires a good deal of dexterity. The easiest way is to fix the whole in a section cutter as it is called. Section cutters are kept for sale by most dealers in microscopes, but a home-made one, which will do very good work, is easily made, and some day we will tell our readers how to make one.

Astronomy for Amateurs.

BY BERLIN H. WRIGHT.

(Calculated for the Latitude of New York City.)

THE PLANETS—MAY, 1880.

	D.	H.	M.	
Venus rises	10	4	11	morning
" "	20	4	4	"
" "	30	3	59	"
Mars sets	10	11	28	evening
" "	20	11	10	"
" "	30	10	50	"
Jupiter rises	10	3	10	morning
" "	30	2	1	"
Saturn "	10	3	49	"
" "	30	2	36	"
Uranus sets	26	0	50	"
Neptune rises	20	3	57	"

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS FOR MAY 21, 1880.

	H.	M.	
Alpha Andromeda (Alpheratz) rises	0	14	morn
Omicron Ceti (Mira) variable "	4	28	"
Beta Perseii (Algol) " sets	8	9	even
Eta Tauri (Alcyone or Light of Pleiades) sets	7	9	"
Alpha Tauri (Aldebaran) sets	7	27	"
Alpha Aurigae (Capella) "	11	16	"
Beta Orionis (Rigel) "	6	40	"
Alpha Orionis (Betelguese) sets	8	14	"
Alpha Canis Majoris (Sirius) "	7	41	"
Alpha Canis Minoris (Procyon) sets	9	52	"
Alpha Leonis (Regulus) sets	0	49	morn
Alpha Virginis (Spica) in merid.	9	19	even
Alpha Bootis (Arcturus) "	10	10	"
Alpha Scorpionis (Antares) in merid	0	25	morn
Alpha Lyrae (Vega) in merid.	2	36	"
Alpha Aquillae (Altair) in merid.	3	48	"
Alpha Cygni (Deneb) rises	6	42	even
Alpha Pisces Australis (Fomalhaut) rises	2	54	morn

NEAR APPROACH OF MOON TO PLANETS, CLUSTERS, AND THE PRINCIPAL STARS.

May 1. Neptune conj. Sun—*invisible.*
" 5. Jupiter 7° South of Moon.
" 6. Saturn ⅘° North of Mercury.
" 7. " 8° South of Moon.
" 7. Mercury 8° " "
" 7. Venus 6° " "
" 9. Moon in Pleiades.
" 10. " 5° North of Hyades.
" 11. " 5° South of Aurigae.
" 11. " midway between Capella and Betelguese.
" 13. " nearly midway between Castor and Pollux (2d mag.) on the North, and Procyon on the South.
" 14. Mars 3° North of Moon.
" 17. Moon 6° South of Regulus, in handle of Sickle.
" 18. Venus very close (½° N.) to Neptune.
" 20. Moon very close to Spica.
" 24. " a little North of Antares.
" 25. Uranus 90° East of Sun.
" 26. Moon 3° N. of "Milk Maid's Dipper."

Penn Yan, N. Y.

Correspondence.

A Cheap Audiphone.

Ed. Young Scientist—For the small sum of ten cents, I can make what I call on "audifan," that will give as good satisfaction as any audiphone invented. I take a common Japanese fan, one with reed handle and braces entire, cut off about one half inch from the top edge, adjust thereto a small strip of tin, binding four or five inches in length and one quarter inch in width when doubled, and clinch the same for a mouthpiece. I then give the whole fan one coat of shellac and lamp-black, using enough black to overcome in part the gloss of the shellac. If one end of a small strip of curved brass wire be inserted just over the string that gives tension to the curved wooden brace, so as to rest against it, and the other end is clinched between the edges of the metal binding, the fan will assume the proper position and always be ready for use. The fan should be painted and allowed to dry thoroughly before the curved brass is adjusted. The fan can be used without the brass brace, if a narrow strip of silk be pasted down the centre of the fan to protect the paper.

L. B. De Veau, New York.

Paste Eels.

Ed. Young Scientist—The paste came safely to hand, and by following your directions, I soon had a large supply, enough for all my friends, but, although it was easy to see the eels by transmitted light, I found it very difficult to get good results with black-ground illumination, because the paste with which they were mixed reflected the light in all directions, and the effect was entirely destroyed. The question then was, how to get the eels free from the paste in which they lived? The following simple manner of solving this problem may be of interest to your readers.

I placed some paste (about a tablespoonful) in the bottom of a tea-cup, and placed it in a warm place. The eels bred and grew rapidly, so that in forty-eight hours it was a seething mass of life. At the same time the paste dried up and became firm. As soon as the paste was so solid that it would not readily mix with water, I placed a piece of stiff paper, about three-quarters of an inch in diameter, on its surface, and on this paper I poured about half a teaspoonful of water. The object of the paper was to prevent the stream of water from disturbing the paste. After the water had stood about half a minute to a minute on the paste, I removed a drop by means of a dipping tube, and deposited it on a clean slide. It was full of eels. and almost quite free from paste, so that when illuminated by very oblique rays, the little animals appeared like luminous serpents moving about in a dark sea. When the paste is allowed to become partially dry, and water is laid gently on its surface, the eels pass at once from the paste to the water and the latter is literally filled with them.

**

Annealing Steel in Boiling Water.

Amateur mechanics who work steel either in the vice or the lathe, are often annoyed by the difficulty of softening certain pieces. Some specimens of steel, when heated to a low red heat and slowly cooled in ashes, become quite soft; other pieces wholly resist this treatment, and although they can be cut and filed, they do not come to that fine softness, which makes a piece of well-annealed steel so pleasant to work. Other pieces again become "pinney," as it is called, that is, full of spots which are quite hard, while the rest of the metal is quite soft. The observations of Prof. W. Mattieu Williams will prove interesting to those who have been troubled in this way. He says: "I will narrate some curious experiments that I commenced when in Sheffield, but have not satisfactorily completed. They were made at the suggestion of Mr. William Bragge, then a managing director of Sir John Brown's works. He had learned that the steel wire strings of piano-fortes are annealed by what appears a very anomalous process—viz., by making the wire red-hot and then plunging it into boiling water. Ordinary experience would suggest that this must harden the steel in some degree, but I tried it upon many samples of steel—mild Bessemer steel, sheer steel of different qualities, and the hardest old-fashioned Sheffield 'pot-steel'—and found that in every case, when the operation was properly performed, the steel was remarkably annealed. I compared samples cut from the same bar—one heated and slowly cooled by burying in ashes under a furnace grate, the other by immersion in boiling water—and found that when subjected to bending tests those which had been cooled in the boiling water would bear a more severe degree of flexure without cracking than the pieces which had been more slowly cooled in the ashes. They were not so soft, as tested by the touch of the file, but unquestionably tougher and more reliable when subjected while cold to violent bending blows of a hammer. It was more effectual than any device of 'oil toughening' or slow cooling I have had opportunities of testing. Certain precautions are necessary. In the first place, the water should be quite at the boiling

point and the steel at a bright red heat; and secondly, the steel should be fairly surrounded by the water. These conditions being fulfilled, the steel remains red-hot under water for some time. It is evidently surrounded by a film of vapor and is not in actual contact with the water, which assumes the so-called "spheroidal state," continuing in this condition until the metal has cooled considerably. I suspect that the toughening is due to the uniformity of cooling thus effected. I commend this method of annealing or toughening to the attention of manufacturers engaged in the production of all kinds of steel that is to be used for purposes where tenacity rather than hardness is demanded."

How to Extract a Fish-Hook.

THE season for fishing is at hand, and while this is one of the sports in which but few accidents occur, it occasionally happens that by an unlucky movement, a hook gets buried in the flesh of the young angler, or of his companions instead of in the fish. In such cases, it is well to know how to get it out, for if allowed to remain, or if awkwardly handled, such a wound may prove an ugly thing. In proof of this, we cut the following account from the columns of a local journal: "Some eight years ago, a lad of thirteen, the son of a prominent citizen, while fishing from one of the wharves, caught a fish-hook in the fore-finger of the right hand, near the roots of the nail, drawing it into the bend of the hook. His father saw at once that the only thing to be done was to open the finger on a line with the hook and take it out, but preferred to call in their family physician to do it. After looking at it for a moment, the doctor, by a sudden twist, wrenched the hook from the finger, minus the bard and point. The parents were justly indignant at such treatment, and insisted that the hook was not all removed, while the boy came near fainting from extreme anguish. The doctor, however, insisted that no inconvenience would result, and dressed the finger in some simple and safe manner, and in due time the wound healed. But the finger and arm troubled him for a long time. After a year or two the lad's health had so far failed as to become a subject of serious alarm to his friends, he being subject to frequent and alarming fainting fits, and other spasmodic affections or symptoms. The state of affairs continued for years, with more or less intensity, until a year or two ago, when the boy's health became nearly or quite restored. The other day the young man, while dressing himself, tore a pimple from his left shoulder, and on examining it, he drew from the flesh the point of the hook which seven years before was imbedded in a a finger on the opposite side of his body."

The danger with most fish-hooks is that the surface and barb are smeared with putrid animal matter, either from the bait, or from the fish that have been caught. When, therefore, an old hook has been imbedded in the flesh, it ought to be cut out with a clean cut, made with a sharp knife so that the wound may be thoroughly washed out. If the hook should be new and used with artificial fly or spoon, take a sharp knife and cut off the thread, etc., with which the hook is attached to the line, and if necessary break off any eye or enlargement that may exist. Clean the shank of the hook thoroughly, and then run the point through the flesh and out.

Curious Experiment on Light and Heat.

IF a piece of wood be placed in a decanter of water, and the focus of a large burning glass be thrown upon it, the wood will be completely charred, though the sides of the decanter through which the rays pass will not be cracked, nor in any way affected, nor the water perceptibly warmed. If the wood be taken out, and the rays be thrown on the water, neither the vessel nor its contents will be in the least affected; but if a piece of metal be put into the water, it soon becomes too hot to be touched, and the water will presently boil. Though pure water alone, contained in a transparent vessel, cannot be heated, yet, if by a little ink it be made of a dark color, or the vessel itself be blackened, the effect speedily takes place.

Practical Hints.

Straightening Hardened Steel.—In hardening and tempering tools they sometimes spring, to the great annoyance of the workmen, and not seldom the tool is reheated and rehardened. In most cases this may be avoided. To straighten a piece of steel already heated and tempered, heat it lightly not enough to draw the temper, and it may be straightened by blows from a hammer, if the character of the tool will admit of such treatment, or, as in case of a tap, it may be straightened by a heavy mallet on a hard wood block. Although the steel when cold would break like glass with this treatment, when slightly warmed it will yield to moderately heavy blows uninjured.

When Trout May be Caught. –The *Sea World*, a sprightly little paper devoted to the fish interests, published at New Haven, Conn., gives the following information regarding the laws of different States in respect to trout fishing.

California, April 1 to November 1.

Connecticut, April 1 to July 1.

Iowa, February 1 to November 1.
Maine, May 1 to October 1.
Massachusetts, April 1 to October 1.
Michigan, May 1 to September 1.
Minnesota, April 1 to October 1.
New Hampshire, May 1 to October 1.
New Jersey, March 1 to October 1.
New York, April 1 to September 1.
North Carolina, January 1 to October 15.
Pennsylvania, April 1 to August 1.
Province of Ontario, Canada, May 1 to September 15.
Province of Quebec, Canada, February 1 to October 1.
Rhode Island, March 1 to August 15.
Vermont, May 1 to September 1.
Virginia, April 1 to September 15.
Wisconsin, April 15 to September 15.

EXCHANGES.

Wanted, coins, minerals, and type; send lists of what you have and what is wanted in exchange. A. Campbell, Derrick City, McKean Co., Pa.

An Excelsior Printing Press, with equipments, comparatively new, cost over $47, for double barrel breech-loading shot gun, with reloading tools and shells. William A. Hervey, Box 134, Taunton, Mass.

To exchange, 400 stamps, all different, in a stamp album, for a small printing press with type, etc. Arthur D. McGerald, 106 Bird Ave., Buffalo, New York.

To exchange, $5 pair of telephones for mounted microscopic specimens, good objective, lathe chuck, watch, type and cases, or offers; describe offers. Wm. R. Brooks, Phelps, N. Y.

What offers for Roger Scroll Saw, 55 large patterns. J. Brower, 3,150 Frankford Road, Philadelphia, Pa.

Revolver, microscope, microphone, 4 magnets, skates, skate sharpener, copying pad, books, magazines, $7 worth of rosettes, and lots of other things to exchange; I will give you a better trade than anyone else can. Chas. T. Conover, Esperance, Scho. Co., N. Y.

Photographs of ten of the most influential Indians of Spotted Tail Agency, including Spotted Tail and family and four oil chromos, very beautiful, for printing press, scroll saw, or offers. Luther Emerson, Creighton, Knox Co., Neb.

"Appleton's Picturesque America," never been read or handled, value $24; "Dana's Mineralogy," $10, and coins, to exchange for a breech-loading shot gun, Winchester or Evan's rifle, or offers. D. M. Fuller, Box 115, Camden, Maine.

Scroll sawing outfit, $6; microscope, $3; pocket telescope, $1; Gaskel's Compendium, $1; Williams' Complete Painters' Guide, $2. What offers for all or part; printing outfit preferred. F. W. McNair, Box 46, Fennimore, Wis.

$7 worth of books or papers, to exchange for a Household microscope or offers. Jonas D. Rice, 221 Academy St., Mercer Co., N. J.

One pair best steel climbing irons, handsome seven shot, 22 calibre revolver, full nickel plate, ten dollars worth of boys' papers, and magazines, for works on natural sciences or offers. W. M. Stribling, Circleville, Pickaway Co., Ohio.

Idaho cabinet minerals, books, revolver, stencil outfit, an electrizer, for well-bound books of travel, biography, history, science, masonry and others of an instructive nature. J. P. Clough, Junction P. O., Lemhi Co., Idaho,

Will exchange phantom leaves or fern roots (maiden hair included), for sea mosses, shells or petrifactions. E. M., New Boston, Mercer Co., Ill.

Wanted, a cornet; must be in excellent order, state what is wanted in exchange. James B. Athearn, New Bedford, Mass.

Wanted, Archæological relics and fossils, for butterflies, beetles, spiders, etc. Correspondence invited. A. W. Baily, Box 195, Pottstown, Penn.

Telegraph instruments with 400 feet of wire and battery, it cost $12; will exchange for scroll saw, or offers. F. Cushing, Wattsburg, Erie Co., Penn.

An improved camera lucida for drawing, etc.; also, a printing press, chase 2½ x 3½, for offers. L. De Veau, 87 E. 10th St., New York.

What offers for a magnificent black walnut mineral cabinet, 5 ft. x 4 ft., desk form, and double, has 4 glass doors, 12 drawers, veneered panels, with drop handles, massive carved legs, and is lined in blue, cost $80 cash. W. L. Farnum, Owosso, Mich.

Postage stamps, spectograph, drawing cards in case, sketch blocks, size 12x20 and 9x12 in., one book, "No Alternative," for minerals, coins, birds eggs, Indian relics or offers. Frank F. Fletcher, St. Johnsbury, Vt.

To exchange: well-mounted slides of hair and fur, for other well-mounted slides of same, lists exchanged. Address, W. Hoskins, 208 S. Halstead St., Chicago, Ill.

Rare insects, minerals, and shells, in exchange for scientific books. P. W. Lee, 310 Marlborough St., Boston, Mass.

A set of carving tools worth 75c.; card stamp and type worth $3.00. State offers, magic lantern preferred. Address Frank H. Libby, Saco, Maine.

A first class sewing machine will be exchanged for books or offers. Address, Lock Box, 22 Schoharie, New York.

Gaskel's compendium, and Virgil's works translated by Dryden. State offers. G. Osgood, Jr., Abington, Mass.

Cocoons of attacus cecropia or mounted specimens of Lepidoptera to exchange for the following cocoons: "A. Luna," "A. Prometheus," "Saturnia Io," a "Ceratomia quadricornus." R. Perry, 50 E. Washington St., Indianapolis, Ind.

Wanted, in exchange for one vol. of "The Boys of New York," or the "Young American," a two line card printer with type and everything complete. Address, W. H. Pretty, Bellville, Ont., Canada.

Wanted, to exchange, Lake Superior copper specimens for type. T. J. Prince, Houghton, Mich.

For exchange, a small lathe, (foot power), 2 sewing machines, 1 Wheeler & Wilson, 1 Singer, medium, in good order, but little used: wanted cabinet makers tools, tent, or scroll saw. R. P. Wakeman, Southport, Conn.

Wanted, a printing press and type; state what is wanted in exchange; "Official" preferred. A. Campbell, Derrick City, McKean Co., Pa.

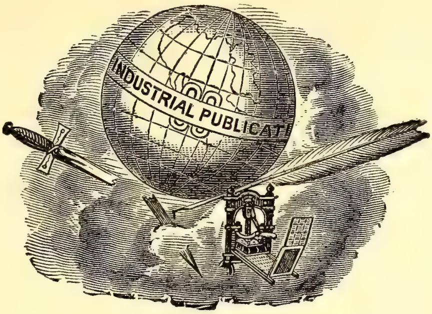
Thos. D. Adams, Franklin, Pa., will exchange a $25 lawn mower, $60 coffee roaster, type, cards and books, $60; poultry journals, $10; 2 cocker spaniels, $30; 1 pair do., $80, and 1 pair $60; for key check outfit, improved model press, or offers.

To exchange, 270 foreign stamps, many new and all different, and a boy's printing press, size, inside chase, 3x4¾ inches, worth $9, for books, microscope, or offers. Henry J. Bott, La Fargeville, Jefferson Co., N. Y.

A Lozo-pendulum board (lined with genuine billiard cloth), consisting of ring toss, bagatelle, pockets, and ten pin, to exchange for parlor magic, aboriginal relics, or offers. T. C. Gard, Frankfort, Indiana.

The Young Scientist

SCIENCE IS KNOWLEDGE.



KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

VOL. III. NEW YORK, MAY, 1880. No. 5.

How the Spider Lifted the Mouse.

ONE of the most interesting books on natural history is a work on "Insect Architecture," by Rennie. But if the architecture of insect homes is wonderful, the engineering displayed by these creatures is equally marvellous. Long before man had thought of the saw, the saw-fly had used the same tool, made after the same fashion, and used in the same way for the purpose of slitting the branches of trees so that she might have a secure place in which to deposit her eggs. The carpenter bee, with only the tools which nature has given her, cuts a round hole, the full diameter of her body, through thick boards, and so makes a tunnel by which she can reach a safe reteat in which to rear her young. The tumble-bug, without derricks or machinery, rolls over large masses of dirt many times her own weight, and the sexton beetle will, in a few hours, bury beneath the ground the carcass of a comparatively large animal. All these feats require a degree of instinct which in a reasoning creature would be called engineering skill, and yet none of them are as wonderful as the feats performed by the spider. This extraordinary little animal has the faculty of propelling her threads directly against the wind, and by means of her slender cords she can haul up and suspend bodies which are many times her own weight. A paragraph has been going the rounds of the papers that a spider recently suspended an unfortunate mouse—raising it up from the ground and leaving it to perish miserably between heaven and earth. Would-be philosophers have made great fun of this statement, and ridiculed it unmercifully. We know not how true it is, but we do know that it *may be* true. Some years ago, in the village of Havana, in the centre of this State, a spider entangled a milk-snake in her threads and raised it some distance from the ground, and this too in spite of the struggles of the animal, which was alive. No doubt some wiseacres will deny the possibility

of such a thing, and intimate that it has its foundation only in the mendacity of the relator, but it is true nevertheless.

By what process of engineering does the comparatively small and feeble insect succeed in overcoming and lifting up, by mechanical means, the mouse or snake? The solution is easy enough if we only give the question a little thought.

The spider is furnished with one of the most efficient mechanical powers known to engineers, viz.: a strong, elastic thread. That the thread is strong is well known. Indeed there are few substances which will support a greater strain than the silk of the silkworm or the spider, careful experiment showing that for equal sizes the strength of these fibres exceeds that of common iron! But notwithstanding its strength, the spider's thread alone would be useless as a mechanical power if it were not for its elasticity. The spider has no blocks or pulleys, and therefore it cannot cause the thread to divide up and run in different directions, but the elasticity of the thread more than makes up for this, and renders possible the lifting of an animal much heavier than a mouse or a snake. This may require a little explanation.

Let us suppose a child who can lift a six pound weight one foot, and do this forty times a minute. Furnish him with 350 rubber bands, each capable of pulling six pounds through one foot when stretched. Let these bands be attached to a wooden platform on which stand a pair of horses weighing 2,100 lbs., or rather more than a ton. If now the child will go to work and stretch these rubber bands, singly, hooking each one up as it is stretched, in just ten minutes he will have raised the pair of horses one foot! In other words, the elasticity of the rubber bands enables the child to divide the weight of the horses into 350 pieces of six pounds each, and at the rate of a little less than one per second he lifts these separate pieces one foot!

Each spider's thread acts like the elastic rubber bands. Let us suppose that the mouse weighed half an ounce and that each thread is capable of supporting a grain and a half. The spider would have to connect the mouse with the point from which it was to be suspended with 150 threads, and if the little quadruped was once swung off his feet he would be powerless. By pulling successively on each thread and shortening it a little, the mouse or snake might be raised to any height within the capacity of the building or structure in which the work was done. So that to those who have ridiculed the story we may justly say: "There are more things in heaven and earth than are dreamed of in *your* philosophy."

What object the spider could have had in this work we are unable to see. It may have been a dread of the harm which the mouse or snake might work; it may have been the hope that the decaying carcasses would attract flies which would furnish food for the engineer. With this, however, we are not so much concerned. Our object has been to explain and render credible some extraordinay feats of insect engineering.

Bird Houses.

A NEATLY-MADE bird house is not only a source of pleasure and profit, from the fact that it attracts the great friends of the gardener and keeps them about the place, but it is also an ornament, if properly located and constructed in harmony with its surroundings. Last year we gave several figures of bird houses with directions for making them, and we now give another which has a different arrangement and appearance, though chiefly constructed out of waste materials. The house shown in the accompanying engraving consists of four nine inch flower pots, resting on a base board shaped as we have figured it in the engraving. Through the centre of the base board there is inserted a pole, which passes through far enough to allow for the height of the flower pots and the thatched roof.

The flower pots are placed around the pole, which is nailed to the base board. A hole is cut into the side of each pot for an entrance for the birds. The pots can be ornamented to suit the fancy, either with plaster of Paris, burrs and lichens, or they may be painted of some sombre color. The second story of the house is

formed into compartments by nailing partitions to the pole, so that when the thatched roof is applied, four compartments are established. For making the thatched roof, the straw is first bound to the top of the pole with wire; it is then brought down to the tops of the pots, and extends over so as to form a continuous eave. The straw composing the thatched roof must be firmly sewed together, either with wire or strong twine. When the roof is completed holes are cut into it for entrance to the compartments. Here again the straw must be carefully bound together, or it will fray apart.

A. W. Roberts.

HOME-MADE BIRD HOUSE.

Skin Preserving.—III.

(Concluded.)

QUADRUPEDS are prepared, when small, in precisely the same way; but owing to the shrinking of lips, etc., they are never satisfactory; and if required for stuffing, had better be packed off at once, unless they can be finished on the spot. Still, skins are ornamental, and I may conclude by one or two remarks as to preparing them for other purposes than stuffing, e.g., mats.

For this purpose I have found nothing better than the alum and salt already mentioned. Taking the animal, the body is laid on its back, a cut made through the

skin from chin to tail, and two transverse cuts across the first to a short distance along the inner side of the legs, as far down towards the feet as the length of skin to be removed from the limb requires. In case the head is not to be retained, a cut is made from the bridge of the nose, past the angles of the jaws, to the first cut below the chin on each side, so that when the whole skin is removed, the included portion remains attached to the jaws, while the eyelids and ears are removed with the rest of the skin, the bone is drawn from the tail. The next step is to tack the skin, with the hair downwards, to a bqard; stretching it only just sufficiently to render it quite flat, and putting the tacks as near the edge as possible. Any adherent fat is then removed with a blunt knife, and the whole surface slightly scraped. It is then thoroughly rubbed with equal parts of alum and salt, and set aside for two days to dry. A second curing, and in two more days a third, are required, and the skin should be by the end of a week nearly dry; but it will be perfectly stiff and hard.

Taking the blunt knife, the best form of which is the ordinary round-pointed table knife, the skin is thoroughly scraped, and the scraping continued till the hard surface is removed, and the skin is as pliant as washleather. In a day or two more a second, very rarely a third, scraping may be necessary, and the skin is then fit for use, and perfectly sweet.

There is one beautiful skin which deserves special mention in connection with this method of curing—the mole's. The best way to preserve it is by making a circular incision round the chest, as close to the "hands" as possible, and then turning the skin inside out over the body; so that as much as possible of the skin is left untouched. The method of drying is to fit the pocket thus obtained over a wooden cylinder, about twelve inches in length, and of the requisite diameter, and proceeding in the usual way. The hind feet may be cut off close to the skin, as they leave no appreciable hole.

So far I have given an outline which may be useful to some of the readers of this journal. I do not lay claim to much originality in method, but I have tried to put myself in the place of a beginner, in describing the ins and outs of the simple process which puzzled myself at first, and to give some idea of the way in which I have learnt to overcome the difficulties I have met with. If I have succeeded, it may be that a rare specimen may be saved from loss, and I am content. Who knows whether, if some Dutchman had only known how to make up a skin, there might not be a stuffed specimen yet existing of the Dodo!—*Charles D. Whistler in Science Gossip.*

Home-Made Telescopes and Microscopes.—V.

ON THE PRODUCTION OF FLAT SURFACES IN GLASS.

THE most important tools required for the work are three circular cast-iron laps, about 6 inches in diameter, having a screwed boss at the back, similar to the face-chuck of a lathe. These must be first turned flat on their faces, and then scraped to a true surface, either from a standard planometer, as practiced by engineers, or else the three may be scraped together till no error can be detected by their interchange. It would, perhaps, be out of place to give the details of this operation, which is described in most elementary works on mechanism. These planes, as left by the scraper, are not sufficiently smooth for the purpose required; they must, therefore, be ground together. One of the plates is screwed down on a stud fixed in the bench or vice, and a wooden knob is fixed into the other to serve as a handle; they are then rubbed together with fine emery and water, frequently interchanging the plates. It is a very difficult matter to bring these plates to an exact plane by grinding alone, and to keep them so during their continued employment. The test of their truth is, that after they are all wiped clean and dry, and rubbed together, the three should present a mottled appearance, uniformly covering the whole of their surfaces. One cause of error is a natural tendency of the grinding-powder to collect unequally between them. This may be somewhat corrected

by frequently wiping it away from the places known to be hollow; and the grinding together should be performed with as little powder as possible at a time, and the strokes so managed as to abrade the high parts only. Practical experience is the best guide for this; and a clever workman will soon learn in what way and direction to work his blocks of glass, etc., on the laps, with very little injury to their plane figure, or even for the purpose of correcting it. In consideration of the extreme accuracy required in the prisms for spectroscopes and other purposes, no pains should be spared in maintaining the perfection of these laps.

If a number of discs of glass intended for small lenses are required to be ground and polished to a flat plane, they must be cemented to a "block;" this is frequently merely a piece of wood turned with a convenient knob at the back for handling; others use a metal plate. Wood is handy for its lightness, but it is liable to warp during the polishing operation, and so shift the discs; to obviate this, I screw a flat piece of slate to the face of the wooden block, with a few common wood screws.

The cement used for the glasses is either pitch hardened with some shellac, or common black sealing-wax. For a small series of discs, a block of about 2 inches in diameter will be found most manageable. The pieces of glass cemented on this are arranged symmetrically, leaving as little interval between them as possible. They are now roughed down on the zinc plate till they are all brought to one level; they are then washed with a nail-brush and well rinsed, and fine-ground on one of the laps, and next smoothed on a circular piece of cast-iron, but little exceeding the diameter of the block of discs. This smaller lap must be carefully ground to a true plane on the larger ones. A little of the finest washed emery and water is spread over this lap with a feather, and the glasses worked upon it in every direction, holding the lap in one hand and the block in the other, and occasionally turning both; this is continued till the emery begins to get dry, the glasses are then washed and wiped dry, and the smoothing proceeded with; but no more water must be applied to the lap. This is now moistened by simply breathing on it. In a few minutes the lap will again become dry; remove the block, and wipe all the emery away about ⅜ths of an inch from round the circumference of the lap; breathe on it again; continue the smoothing, and also wipe the emery away from the outside till, finally, scarcely any is left, and the glass is nearly finished on the metal itself. If this operation is properly conducted, the glass will have a transparent surface free from scratches and greys, and so near a polish that a few minutes only on the polishing lap will be required. But one rule must be strictly adhered to, viz., never to polish a glass surface with any scratches in it. It is worth while to spend any amount of time in smoothing rather than to do this, and the operation must be repeated again and again, till no scratch whatever can be discovered. It is quite evident that to obliterate a scratch by polishing, the whole surface must be worked away till the bottom of it is reached. This makes the operation long and very tedious, and is almost certain to injure the perfectly flat plane which has been obtained by careful smoothing.

It is a difficult and hazardous task to polish glass on hard metal, as the surface is very liable to tear up. Consequently, the usual system is to employ a soft and partly-yielding material, in which the particles of polishing powder may be imbedded. For facing the lap, I employ beeswax hardened with resin, and stir some finely-washed ochre into the melted mixture. The lap itself is simply a brass plate, about 3 inches in diameter, which screws on to the lathe mandril; some of the above material is poured on to this, and spread over a layer of about 1-16th of an inch thick. When cold, it is turned off flat, and, to make it perfectly true, the whole face is scraped off at once with a hardened steel-cutting straight-edge. An old parallel cotter file will answer the purpose, ground from both sides like a blunt knife, and finally corrected on one of the cast-iron laps with emery. A series of shallow grooves, about an eighth of an

inch asunder, are now turned in the wax, and some cross scratches made radiating from the centre, from which a piece should be taken out. The polishing powder, consisting of a mixture of crocus and putty-powder, before described, should be mixed in a small gallipot with plenty of water, and applied to the lap with a feather. The lathe is now run at a pretty quick speed, and the block of glasses worked over it in every direction with considerable pressure. If the smoothing has been properly done, as directed, a few minutes will suffice to give the requisite polish, which is seen to take place equally all over the glasses; but if any scratches should develop themselves, it is better to repeat the smoothing than attempt to polish them out. This same method is employed if the glass were one continuous plane instead of numerous pieces.

Fig. 7.

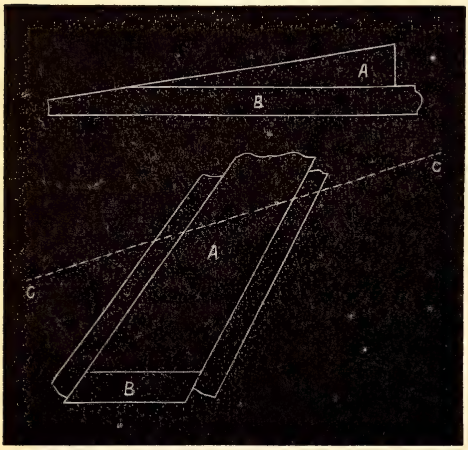


Fig. 8.

For minute prism work, where the size is required to be only just sufficient to transmit or reflect the pencils from a microscope object-glass, and the surface has to be perfectly up to a sharp edge, somewhat different practice must be adopted; for however carefully the smoothing or polishing may be performed, a rounding of the extreme edge always occurs. To obviate this, the edges must be guarded, as in the following examples:—A (Fig. 7) is a prism to be worked to a very acute angle. A piece of glass (Fig. 7), large enough for the purpose, having one side polished, is cemented with Canada balsam to a parallel plate of glass (B); they are then ground off together to the required angle and polished; the marginal error will be taken up by the lower end of the under plate. It would be impossible to make an acute wedge of this figure in any other way, and when separated it will be found to have a knife-edge perfect in the extreme.

Another example may be described from my practice in making the first prisms for the binocular microscope. A (Fig. 8) is an end view of the intended prism; this is supposed to have been a block of glass of larger size, with one polished surface cemented with Canada balsam on to the guard plate (B); the front and back reflecting surfaces are then smoothed and polished; these are then covered with guard-plates, and the top emergent surface of the prism ground off and polished to the dotted line (C, C). It will thus be seen that every corner of the prism is protected during the working, and is kept absolutely perfect to the edge. The prisms were made sufficiently long to be cross-cut into three or four. The smoothing was performed in accordance with the foregoing directions, but the polishing lap was required to be much smaller. The one I employed was only $1\frac{1}{2}$ inches in diameter. If a large lap is used, the polish is apt to commence on the margins of the glass; and if this is the case, a true reflecting figure will never be obtained. The polish should begin in the centre and spread to the outside. The proper angles for these prisms were set off by a graduated steel sector, and, as the measurements have to be taken from the back of the guard-plates, it is necessary that these should be exactly parallel; if not so, they must be ground on the surface-laps till all the edges gauge alike.

I may here remark that I am merely recording what has been my own self-acquired practice, and which is perhaps neither the most expeditious nor easy. My best apology must be, that I have always secured perfectly accurate results by these methods, and when a few only are required, I must confess that I do not

see a better way. But the great demand that has arisen for binocular prisms has induced the makers to discover a plan of working them in blocks, a number at a time, the particulars of which I do not pretend to explain.

Some very excellent prism work is produced on the Continent, and as the mode of polishing is peculiar, it may be worth while to record it. Chevalier & Co., of Paris, through Messrs. Beck, politely sent me an explanation of the process, together with a sample of all the grinding and polishing materials used in their business. After the surface of the prism is smoothed, a piece of very thin, smooth paper (much resembling photographic negative-paper) is cemented by its extreme ends with a little gum or dextrine to the metal lap; a lump of yellow tripoli (labelled "Tripoli de Venise") is then rubbed dry over the paper, and the prism, also dry, polished thereon by hand movement; generally not more than two or three applications of the powder are required. I have tried this method with the identical paper and polishing material, but must state that, in my hands, the result has not been satisfactory for accuracy, at least in very small prisms; for larger ones it may answer better.

Management and Selection of Aquaria.

BY A. W. ROBERTS.

I CANNOT urge too strongly the wisdom of beginning the study of aquaria on a small scale at first, so that the fundamental principles may be mastered before much money has been expended on a large and expensive tank, which will, in all probability, result in discouragement and failure.

For the first lesson I would advise the use of a candy jar (see engraving). Having filled it with soft water, expose it to the full action of sunlight from two to four days, at the expiration of which time the spores of various kinds of confervæ contained in the water will have been developed, and the inside of the glass jar will have become thickly coated with confervæ. Continue to expose the jar to the full force of the sun's light and heat ray's, no matter how high a temperature the water may attain, and a second development of plant life will take place, which will be known by the water becoming of a thick opaque green color, from the presence of millions of microscopic plants, which have the power of moving about in the water. These facts, and many

TALL JAR FOR AQUARIUM.

others which might be cited, go to prove how universal is the diffusion of the spores or seeds of low forms of animal and plant life, which only require the proper conditions of light, heat and air to develop them.

We will now take this jar and place it where it will receive *cool diffused daylight, but no direct sun rays*, and will also place a dozen snails in the jar, a fresh-water mussel, and a small bunch of mermaid-weed. In three days the water will have become perfectly clear. In consequence of the lowering of the temperature of the water in the jar, caused by depriving it of the direct action of sunlight, the green coloring substance, or locomotive plants, contained in the water, have ceased to exist as living plants, but their remains may be found deposited on the bottom of of the jar in the form of a dirty-looking loose brown substance. This deposit of decayed vegetable matter is termed "humus," and is quite harmless in an aquarium. The fresh-water mussel has also helped to destroy immense quantities of these vegetable organisms, and if you watch him with a magnifying glass you will see a constant stream of water loaded

with debris being drawn into his syphonal or feeding tube. The snails have not cleaned off the confervæ on the sides of the glass to any great extent, except in streaks here and there, where they have rasped it partially off with their lingual ribbons. We will now envelop the jar in a wet towel to within an inch of the surface of the water. This will reduce the temperature of the water, and at the same time reduce the amount of light passing into the jar. The mermaid-weed will throw off enough oxygen to support the animal life contained in the jar for two days, for which length of time we will leave it. Before the expiration of two days all the conferva on the glass will have died and passed into the condition of humus. This result is caused by the reduction of the light, and the lowering of the temperature of the water, caused by the application of the wet cloth. The snails will now be seen going over and over the gravel at the bottom of the jar, particularly the Planorbis snails, in search of any remaining dead vegetable matter and conferva, of which they are very fond.

The water has now become as clear as crystal. Not a vestige of these billions of plant organisms is to be seen—all have been eaten by the snails and mussel, who have converted them into harmless earthy excremental deposits.

We will now go over the ground once more, just to see what this first lesson has gained us in knowledge. First, then, we have the positive proof that all pond, river, and rain water contains immense quantities of the spores of low and minute vegetable organisms, which are ready and waiting to be developed into visible growths whenever the conditions of proper resting places, light, and heat, are given them.

Secondly, that whenever, from excess of light and heat, these vegetable organisms are developed too fast, causing the tank to look unsightly, they may be overcome by removing the causes that produced them; that is, by decreasing the amount of light (not wholly cutting it off), and at the same time lowering the temperature.

Thirdly, the utilizing of molluscs in an aquarium, but not to the extent of expecting them, unaided, to clean the glass of all vegetable growths, as has been so often stated in books on aquaria.

Fourthly, the nature of decaying vegetation and its affording food for snails.

Fifthly, the harmlessness of excremental substances, and even their positive benefit in a fresh-water aquarium.

Sixthly, and above all, the great error of *piling water up* instead of *spreading it out* and exposing it on all sides to the action of light and heat.

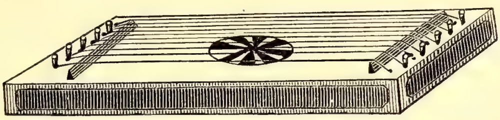
The Æolian Harp.

THE season has come when open windows are pleasant, and we invite into our houses the cooling breeze loaded with the perfume of flowers. To the fragrant air of the garden it is easy to add the wild melodies of nature's music, and we propose to tell our readers how to do it.

The Harp of Æolus is supposed to have been invented, or at least greatly modified by the famous Kircher, who named it after Æolus, the god of the winds. It consists of a long box, such as that shown in the engraving, made of any light wood, good clear pine answering very well. The length of the box should be the same as the width of the window in which it is to be placed, and it may be five or six inches wide, about two deep. The top of the box is strengthened at the ends by nailing or glueing an extra piece on it so that it may hold more firmly the pegs used for fastening the strings, and there is at each end a bridge similar to the bridge of a violin. As the top of the box forms a sort of sounding board, there is a hole cut in it, as shown in the figure.

There may be from one to twenty strings—five being a very good number. They are stretched over the bridge and fastened at each end by means of pins, just as is done in the violin. When these strings are in unison, and the instrument is exposed in the window to the action of a gentle breeze, they will emit the most agreeable combination of wild and melting sounds, changing from one harmonic of the string to another, according to the varying impulse of the wind, and its unequal

action on the different parts of the vibrating strings. In the Æolian harp constructed by the Rev. W. Jones, the strings, instead of being on the outside were fastened to a sounding board within a wooden case, and the wind was conveyed to the strings through a horizontal aperture. Such an instrument might be used even in the open air. Dr. Young says: "To remove all uncertainty in the order of the notes in the lyre, I took off all the strings but one; and on placing the instrument in a due position, was surprised to hear a great variety of notes, and frequently such as were not produced by any aliquot part of the string; often, too, I heard a chord of two or three notes from this single string. Discords are also often heard from the unison strings of this instrument; the cause of which is evident from the manner in which the notes are generated; for the aliquot parts of a string contain in themselves an infinite variety of discords."



ÆOLIAN HARP.

Zincography for Amateurs.

IN a recent paper read before the London Society of Arts, Mr. Thomas Bolas, F.C.S., described zincography as a simple and easy mode of printing in the following fashion: Zincography, he said, is similar to lithography, except that a zinc plate is employed in the place of the lithographic stone. The so-called transfer paper is merely a moderately fine paper which has been brushed over on one side with a mucilaginous mixture, prepared by boiling together the following: Water, 1000 parts; starch, 100 parts; gamboge, 6 parts; glue, 1 part. This paper is written upon with the ordinary commercial lithographic writing ink, which has been rubbed up with water like an artist's water-color. The writing being dry, it is necessary to moisten somewhat the back of the transfer by means of a damp sponge, after which it is laid face downward on a sheet of ordinary roofing zinc, which has been previously cleaned by means of emery cloth. Both being now passed together under the roller of a small press, the transfer adheres to the metal plate; but on damping the back of the paper it becomes easily removable, leaving the writing on the zinc. The face of the zinc plate is now gently rubbed over with mucilage of gum arabic, which is all the better for being slightly sour, and the excess of gum having been sponged off, an india-rubber inking roller charged with ordinary printer's ink, is passed over the still damp zinc plate a few times. The ink takes only on the lines of the transferred writing, and it is merely necessary to lay a sheet of white paper on the plate and to pass both through the press to obtain an impression—an exact reproduction of the original writing. Any number of copies can be printed by repeating the operations of damping and inking. The zincographic process, thus simplified, is rapid, economical, and within the reach of every one.

Antique Bronzing and its Imitation.

The deep green, blue, and blue-green covering of copper and bronze which develops under the influence of dampness and air, is technically called patina, and consists of carbonate of copper. It has been observed that bronze statues in large towns are no longer covered with this patina, but turn black, while those statues which have been erected in the country and in parks are still covered with the greenish covering. Some kinds of bronze turn green sooner than others, which is specially the case with those containing much zinc, little lead, and no tin. The principal thing, however, in a statue, is a clean surface, which has been obtained by filing, etching, and polishing, and which is retained by frequent washing with water. In some places

the surface is kept clean by being rubbed down once a month with olive oil. The artificial patina is obtained by first cleaning the bronze and then dipping it into a solution of vinegar and water, after which it is exposed for some weeks to the influence of damp carbonic acid gas. Or the bronze may be painted with a solution of 4½ parts sal-ammoniac, and 1 part oxalic acid, in 94½ parts distilled vinegar. The modern imitation patina, to be seen on lamps and statuettes, can be produced by using a paint consisting of carbonate of copper and light spirit varnish (sandarach lacquer or photographic negative lacquer); this greenish lacquer is then put on the objects to be treated, with a brush, like paint. The green paint then collects in the recessed parts, and, when dry, looks like patina. This proceeding is specially to be recommended where objects with imitation patina have been damaged and are to be restored. Carbonate of copper gives a bluish color—verdigris (acetate of copper) a light green shade. Intermediate tinges are obtained by mixing the two.

Astronomy for Amateurs.

BY BERLIN H. WRIGHT.

(Calculated for the Latitude of New York City.)

THE PLANETS—JUNE, 1880.

	D.	*H.*	*M.*
Venus rises	10	4	0 morning
" "	30	4	18 "
Mars sets	10	10	28 evening
" "	30	9	45 "
Jupiter rises	10	1	22 morning
Saturn "	10	1	6 "
" "	30	0	41 "
Uranus sets	20	11	9 evening
Neptune rises	20	2	0 morning

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS FOR JUNE 21, 1880.

	H.	*M.*
Alpha Andromeda (Alpheratz) rises	10	8 even
Omicron Ceti (Mira) variable "	2	25 morn
Beta Persei (Algol) " "	11	48 even
Eta Tauri (Alcyone or Light of Pleiades) rises	2	12 morn
Alpha Tauri (Aldebaran) rises	3	31 "
Alpha Aurigae (Capella) "	0	59 "
Beta Orionis (Rigel) invisible.		
Alpha Orionis (Betelguese) invisible.		
Alpha Canis Majoris (Sirius or Dog Star) invisible.		
Alpha Canis Minoris (Procyon) invisible.		
Alpha Leonis (Regulus) sets	10	43 even
Alpha Virginis (Spica) sets	0	43 morn
Alpha Bootis (Arcturus) in merid.	8	8 even
Alpha Scorpionis (Antares) in merid	10	19 "
Alpha Lyrae (Vega) in merid.	0	34 morn
Alpha Aquillae (Altair) in merid.	1	46 morn
Alpha Cygni (Deneb) in merid.	2	38 "
Alpha Pisces Australis (Fomalhaut) rises	0	52 "

NEAR APPROACH OF MOON TO PLANETS AND STARS, AND OTHER PHENOMENA.

June 2. Mercury in superior conj. with Sun.
" 2. Jupiter 7° South of Moon.
" 3. Saturn 8° " "
" 4. Neptune 6° " "
" 5. Moon 2° South of Pleiades.
" 5. Venus 5° in Taurus.
" 6. Moon 8° North of Aldebaran.
" 6. Venus 3° in Taurus.
" 7. Moon Apogee and highest.
" 7. Moon 4° South of Auriga or El Nath, (2d mag), and nearly midway between Capella and Betelguese.
" 9. Moon, with Procyon S.E., Betelguese S.W., and Sirius S., forms a huge diamond.
" 11. Mars 4° North of Moon.
" 13. Moon 5° South of Regulus.
" 13. Mars 8° in Cancer.
" 14. Uranus 6° North of Moon.
" 17. Mars in Aphelion.
" 19. Jupiter 16° in Pisces.
" 20. Moon very close to Antares.
" 20. Sun enters *sign* Cancer (*constellation* Gemini), and Summer begins.
" 21. Moon Perigee and Lowest.
" 22. *Total Eclipse* of *Moon*, invisible in Eastern States, and the beginning only visible in California, the Moon setting partially eclipsed.
" 27. Saturn 26° in Pisces.
" 30. Jupiter 7° South of Moon.

THE MOON, II.

Directly north of Mare Crisium (A), in the first or N. W. Quadrant, is a large number of walled plains or ampitheatres. Their interiors bear a perfect resemblance to the outside grey plains, like a great entrenchment thrown around an undisturbed surface.

The ring or wall is usually steepest within, and in many instances built up in vast terraces, each terrace evidently marking the ancient level of a molten lake. High peaks occasionally spring up from the wall, like watch towers, and gateways break through the rampart.

Close upon the northern border of M. Crisium is the walled plain Cleomedes (12), 78 miles in diameter. It includes a small brilliant crater. North of 12 is Burckhardt (19), 35 miles in diameter, the interior being 12,700 feet below its east wall. Geminus (20) is 54 miles broad, and the wall upon the east side is 12,300 feet high, and the western wall 16,700 feet high. At the west,

and close to 20, is a small ampitheatre (21), having walls of the same height as 20, but far more precipitous; it is called Bernouilli. To the right or west of 21, and very close to the limb of the Moon at full, is Gauss (22), a very conspicuous object near sunset, when the shadow of its mighty wall on the west is thrown across the interior plain, enshrouding the base of its central mountain, while the inside of the eastern wall is bathed in sunset's golden rays; it is 110 miles long.

Endymion (27), Atlas (28), and Hercules (29) are three large walled plains, situated about 32° from the north lunar pole in the N. W. Quadrant. 27 is 78 miles in diameter, and its irregular wall in some places more than 15,000 feet, "overtopping all but the very highest peaks of the Alps." It is best seen 3d. 7h. after New, and 2d. 9h. after Full. Atlas is a grand ampitheatre 55 miles broad, containing 460 square miles. Its ring rises on the north 11,000 feet, and is exceedingly rich in terraces and towers. A small and very dark spot is near the centre. Hercules is the companion of Atlas, being only a few miles east. It is 46 miles across, and the ring is *double* in places. Best seen 5 or 6 days after New, or 3½ days after Full.

South of these are several incomplete rings, all opening northward. At the right of 27, Mare Humboldtianum (B) forms part of the W. Limb, and the peaks of its border sometimes appear in profile 16,000 feet high.

Penn Yan, N. Y.

What Old Triangular Files Can be Used For.

TRIANGULAR files when worn, are generally thrown aside as worth but very little except for old steel, but their sphere of usefulness need not end here.

Probably one of the most curious uses to which such a file can be put is that it can be made into a very good glass cutter. Grind the three sides at the point smooth, so that the teeth are obliterated. Grind the sides flat, but shape the point curved or convex. To use it, hold the tool so that one of these sharp rounded edges will bear upon the glass, and with a little pressure, draw it steadily over the glass. The result is a slight scratch or cut, and by using a little force the glass will break where this scratch is seen.

If the teeth of an old file be removed by grinding, and the taper shape be preserved, it will make a passable hand reamer. If the point be made obtuse or "stunt," it forms a convenient substitute for a hand countersink. If the tool is put in a hole that is to be enlarged it will be observed that there is an equal bearing at the three points, which gives a steady hold on the metal to be removed. Now turn the tool a little so that it will cut. Observe the position and shape of this cutting edge. To the initiated it will present about the same form as that of the cutting edge of the tool used by the machinist to cut iron in the lathe.

The form of the file being three-square, or triangular, the edges present an angle of 60 degrees. This is the strongest and best angle known to cut iron and the hard metals. This same angle is used by the machinist to shape the points of his lathe centres, and also to make the indents in shafting and the work to be put on these centres to be turned. It may also be mentioned that screw-threads, when correctly made, have this same angle. It may very properly be called "the angle of strength."

As a scraping tool to remove an amount of metal in a short space of time, the old file, when properly ground, has no equal. It can be used to scrape out curves and hollows and finish rounds and swells. No other shaped tool would answer as well.

If ground after the manner of a graver, the old file can be used as that instrument, answering all that may be required of it, being capable of producing much good work.

As a hand turning tool for working iron, brass, ivory, bone, the softer metals as well as the harder woods, it makes a most excellent tool. One form may be made by grinding the sides smooth and making the point sharp. The tool then presents three cutting edges, and serves some of the purposes of the diamond-pointed tool. If the file be ground at the end with three obtuse cutting edges, it can be used precisely like the diamond-pointed tool, and is very strong and durable for cutting metals. If the file be broken off square and only one cutting edge be made across the broken end, it will make a useful turning tool for some purposes.

One great advantage in using old files of this kind for tools is that the file is already made and shaped to receive the handle, and is tempered the entire length to the commencement of the tang. Renewing by grinding will produce a cutting edge with no occasion to harden and temper. Its cost to be made into a very good tool is very little. As a general thing, other tools are tempered but a short distance from the cutting edge, and after being used enough to have this worn or ground away, the temper must be renewed.

In selecting old files for tools it may be borne in mind that as a general thing coarse-cut files or files with coarse teeth are make of a grade of steel not so fine as those that are made with fine teeth. As a hint to get a good tool, select an old file that is cut with fine teeth.—*Blacksmith and Wheelwright.*

EXCHANGES.

Wanted, "Butler's Family Aquarium;" will give in exchange two books, entitled "Laughing Gas" and "De Walden's Ball-room Companion." E. R. Brown, Box 25, Covington, Ind.

A small printing press and outfit, cost $12, for steam engine, Demas lathe and scroll saw, or offers. Ernest Corthell, Rockport, Maine.

A patent spectograph, cost when new $1.25; rare minerals, birds' eggs, and postage stamps, to exchange for minerals, foreign coins, Indian relics, or offers. Frank F. Fletcher, St. Johnsbury, Vermont.

Eggs, of the English sparrow, for good specimens of other birds' eggs; botanical specimens mounted and unmounted to exchange; lists exchanged. C. R. Hexamer, New Castle, Westchester Co., N. Y.

Two telegraph instruments, nearly ½ mile of wire, one battery; also 4 in. magnet. 8 Scientific American Supplements, full of information; new history of United States; a $4 German silver-trimmed flute; what offers? Ewing McLean, Greencastle, Ind.

Wanted, The Workshop Companion; I have Gaskell's Compendium, $1; The Round-of-Months, 75c.; Amateur's Hand Book, 15c.; also books, papers, pictures, etc.; send lists of what you have to exchange. W. B. Moore, Morgan Station, Ky.

McAllister's magic lantern and 30 pictures (cost over $95), to exchange for job type and material, or a good microscope and specimens; $20 worth of novels for a good $15 or $20 household microscope; rare mineral and Indian relics for exchange or sale; refers to editor. John T. Patrick, Wadesboro, N. C.

What is offered for one of the Climax extension step ladders? H. E. Phelps, Manhall, Michigan.

Wanted, a good microscope in exchange for a scroll saw; instrument must be in good order, and magnifying power of from 200 to 300, or 400 diameters. H. E. Rhodes, Brighton, Iowa.

To exchange, a $3 microscope for some old issues of Canada postage stamps. Wallace Ross, Lock Box 97, Rutland, Vt.

Wanted, a printing press; have for exchange a good microscope (Smith & Beck, London), 3 object glasses, and three eye pieces, power from 15 to 600 diameters, original cost $60; books, chemicals, guitars, and other things for exchange. E. F. Underwood, 9 Murray St., N. Y.

Wanted to exchange, Colorado minerals, such as jasper, smoky quartz, silicified wood, etc., for good specimen fossils, or perfect crystals of minerals of other localities. H. F. Wegener, Denver, Colorado.

One Natural Philosophy, one Bryant & Stratton's Counting-house Book, and two long bows, with arrows, to exchange for cabinet specimens or curiosities. W. D. Wright, Lock Box 17, Bremen, Indiana.

Wanted, coins, minerals, and type; send lists of what you have and what is wanted in exchange. A. Campbell, Derrick City, McKean Co., Pa.

An Excelsior Printing Press, with equipments, comparatively new, cost over $47, for double barrel breech-loading shot gun, with reloading tools and shells. William A. Hervey, Box 134, Taunton, Mass.

To exchange, 400 stamps, all different, in a stamp album, for a small printing press with type, etc. Arthur D. McGerald, 106 Bird Ave., Buffalo, New York.

Revolver, microscope, microphone, 4 magnets, skates, skate sharpener, copying pad, books, magazines, $7 worth of rosettes, and lots of other things to exchange; I will give you a better trade than anyone else can. Chas. T. Conover, Esperance, Scho. Co., N. Y.

To exchange, $5 pair of telephones for mounted microscopic specimens, good objective, lathe chuck, watch, type and cases, or offers; describe offers. Wm. R. Brooks, Phelps, N. Y.

What offers for Roger Scroll Saw, 55 large patterns. J. Brower, 3,150 Frankford Road, Philadelphia, Pa.

Photographs of ten of the most influential Indians of Spotted Tail Agency, including Spotted Tail and family and four oil chromos, very beautiful, for printing press, scroll saw, or offers. Luther Emerson, Creighton, Knox Co., Neb.

"Appleton's Picturesque America," never been read or handled, value $24; "Dana's Mineralogy," $10, and coins, to exchange for a breech-loading shot gun, Winchester or Evan's rifle, or offers. D. M. Fuller, Box 115, Camden, Maine.

Scroll sawing outfit, $6; microscope, $3; pocket telescope, $1; Gaskel's Compendium, $1; Williams' Complete Painters' Guide, $2. What offers for all or part; printing outfit preferred. F. W. McNair, Box 46, Fennimore, Wis.

$7 worth of books or papers, to exchange for a Household microscope or offers. Jonas D. Rice, 221 Academy St., Mercer Co., N. J.

One pair best steel climbing irons, handsome seven shot, 22 calibre revolver, full nickel plate, ten dollars worth of boys' papers, and magazines, for works on natural sciences or offers. W. M. Stribling, Circleville, Pickaway Co., Ohio.

Idaho cabinet minerals, books, revolver, stencil outfit, an electrizer, for well-bound books of travel, biography, history, science, masonry and others of an instructive nature. J. P. Clough, Junction P. O., Lemhi Co., Idaho,

Dumb bells of all sizes, to exchange for most any thing; send for circular containing weights of them to J. P. Donohue, Box 7, Davenport, Iowa.

Wanted, scientific books and papers, microscope, drawing instruments, telephone, stamps and coins, in exchange for scroll saw, type, cards, revolver, shot gun, magazines, scientific books, or almost anything. W. L. Goodsell, Bath, N. Y.

A pair of New York Club skates, worth $3.50, also coins, minerals and postage stamps, for books or offers; correspondence invited. E. F. Greene, P. O. Box 889, Bath, Steuben Co., N. Y.

A nice marine oil painting, ready framed, worth $5.00; state what is offered in exchange. C. Hammond, Artist, P. O. Box 47, Chatham, Barnstable Co., Mass.

Photographic camera, one portrait and one landscape tube, with chemicals complete, in exchange for medical books. J. Frederick Herbert, 1,324 Poplar St., Philadelphia, Penn.

What offers for 1 Household Microscope, one 8 shot breech-loading carbine, 1 new 7 shot pistol and cartridges, 1 small gold watch, 1 small gold chain, 1 violin and case, one new darning machine. Lock Box 147, Tarboro, Edgecombe Co., N. C.

Back Nos. "Penman's Art Journal" for 1879; Gaskell's Compendium, $1; Coe & Shells' Pen and Ink Drawing, 25c.; Pettengill's Fortune Teller, 40c.; Hand-Book of Business, 25c.; in exchange for microscope, printing press, or offers. M. B. Moore, Morgan Station, Ky.

Trump's and Russel's scroll patterns, worth $10; for large lenses preferred. H. J. Peters, Rogersville, Ohio.

Lessons in Standard Phonography given in exchange for a printing press, lathe, scroll saw, scientific books, hammock, or offers. Phonographer, Box 331, Topeka, Kans.

Wanted, chemical apparatus, in exchange for "Phrenological Journal," $2, and the last six numbers of "American Agriculturist," 75 cents, of 1879. T. P. Potts, Canonsburg, Pa.

Land and fresh water shells, birds eggs, minerals, fossils (correctly named), or books, Gray's "How Plants Grow," Pope's "Linear Perspective Drawing," in exchange for a Multum in Parvo

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

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Management and Selection of Aquaria. II.

BY A. W. ROBERTS.

IN a previous article we studied experimentally the effect of light and heat on the vegetable spores and germs which are contained in almost all water. We will again fill the jar up to the rim with fresh water, and then take a wash basin or any shallow vessel of earthenware or wood, and pour into it the same amount of water that is contained in the jar, seeing that the water in the shallow vessel is not less than three inches in depth. We will now place both vessels in a shady (not dark) position, where no direct sun rays ever reach them. Into each vessel we will place a small sun-fish or striped dace (*not Pigmy dace, eel, or gold fish*) of as nearly equal size as it is possible to obtain. We have now got each vessel, as regards the size of the fish and the amount of water and light, exactly alike. The dace in the glass jar for the first twenty-four hours will remain at the bottom; during the next twenty-four hours he will have changed his position to the centre of the body of water contained in the jar, and in the next twenty-four hours he will be hugging as close as he can get to the surface of the water; he will have lost his color, and will be gasping, weak, and tired. And in a few hours more he will be found dead at the bottom of the jar, or in the agony of suffocation he will have jumped out.

We will now examine the dace in the wash basin. Oh, he looks splendid! How active he is. How bright his colors; and perhaps he will take a small piece of angle worm; yes, he has taken it, and is looking for more—a sure sign of perfect health in a fish. How long will he live in that water without its being changed? A week, unless the atmospheric temperature increases.

Now what does this go to prove? First, that in aquaria, or vessels made for con-

fining fish, where the water remains unchanged and at rest, the water should be spread over as great a surface as possible, and at the same time should present a reasonable depth for the perfect display of the animals.

In the case of the glass jar, surrounded on all sides with light, the water becomes warmer than that in the wash basin, and as a consequence it is in a condition to take up less oxygen. Fish placed in vessels composed entirely of glass, become greatly woried and excited for the first few hours, caused by glare of light on all sides, in their vain attempts to pass through the glass and thus make their escape; and then, again, they are under constant alarm, caused by the moving objects that surround them. Under these exciting conditions they breathe much faster, and consequently exhaust the oxygen more rapidly than when in a natural condition.

I know a scientific gentleman who some years ago kept a fresh-water crayfish for over two years. It must be remembered that this crustacean is considered by dealers to be one of the most difficult animals to keep in stock. The secret of his success was entirely due to the shallowness of the water in which the crayfish was kept. I will quote his own words:

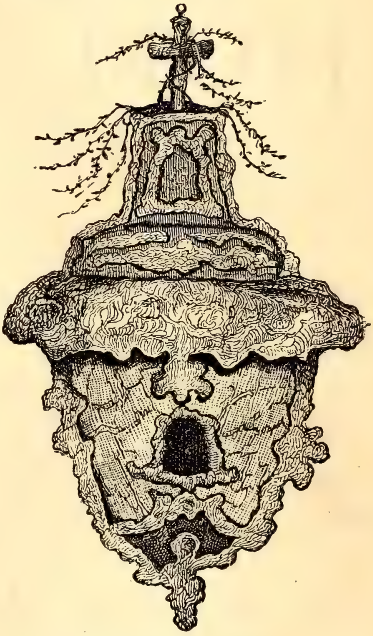
"I have succeeded in keeping a crayfish for over two years, which I have kept in water not more than an inch and a half deep, previous experiments having shown that in deeper water these animals always died in course of time for want of sufficient aeration. His appetite during the two years was always good. *The water was never changed,* but some was occasionally added to supply the loss by evaporation. Had this crayfish not met with an accident it might have lived many years longer."

I had, on one occasion, a number of dace live and do well in a long tank where the water was shallow, and stood during the day at a temperature of 78° Fahr.

It is well to remember that air dissolved by water is always richer in oxygen than the atmosphere breathed by terrestrial animals. One-third of the air absorbed by water consists of oxygen, instead of only one-fifth, as is present in the atmosphere.

A Hanging Bird House.

THE bird house represented in this figure is constructed out of a combination of flower pots and old milk pans, arranged so as to resemble, in form (when coated with plaster of Paris), an acorn. The top consists of a five-inch flower pot inverted, which has the bottom cut out. This pot is fastened to an old milk pan; this pan is fastened to a larger-sized pan, the rim of which extends over a 14-inch flower pot. The small flower pot and the tin pans are to represent the cup of the acorn, when coated with plaster of Paris. The 14-inch pot is to represent the nut of



HANGING BIRD HOUSE.

the acorn. Both pans are punched full of holes, so that when the plaster is laid on it will pass into the holes and clinch, otherwise it will not adhere to the smooth surface of the tin. Holes are made in the bottoms of the pans and the large pot, for a turned picket or stick to pass through; at the bottom of the large pot a hole is bored through the picket into which a pin of iron or wood is inserted to prevent the pots and pans from slipping off. In applying the plaster to the pot I

use an extra quantity where the pots and pans join together. The bottom of the 14-inch pot was extended with plaster, so as to form the point of the acorn. The interior of the large pot was divided into two compartments, holes being cut into the sides of the pot for entrances. These holes are easily cut with an old knife made into a saw by "hacking" it.

In ornamenting this bird house I took advantage of the subdued red color of the pot, which I slightly veined with plaster. The rough coating is applied with a broad-bladed table knife or "pointing" trowel. After the plaster is dry, a coat of sombre green paint is applied. Where the stick passes through the top pot a cross is formed by nailing on a cross piece. The small inverted top pot is filled with earth, and planted with tradescantia or German ivy.

Under the eaves, formed by the projecting pan, numbers of holes were bored through the pot and into the compartments, to secure sufficient ventilation inside.

This bird house should be suspended from the branch of a tree by means of a stout wire attached to a strong screw eye, firmly inserted into the rod which passes through the centre of the house. The end of the rod should be firmly bound with annealed wire to prevent its splitting, and the iron hook should be heated and dipped in melted grease before being screwed in. This will prevent its rusting and losing its hold. Rope or sash line should not be used for suspending the house, as they are apt to rot and break, and besides this they twist and untwist, and so cause the house to twirl round, making it unsteady.

Home-Made Telescopes and Microscopes.—VI.

ON THE PRODUCTION OF SPHERICAL SURFACES IN GLASS.

AS the radii required in the construction of microscopic object-glasses are seldom very long, the templates for all sizes above 1-5th of an inch in diameter are usually made of steel, such as thin saw, spring, or busk-steel, not softened, but turned hard, as obtained. A hole is punched through the middle of a square plate with a centre punch, the hole is then rounded out with a taper rimer. The piece of steel is next broken round as near as possible to the size of the circle required, by clamping it in the vise and driving off the surplus metal round the edge with a chisel held close to the jaws. This steel plate is driven on to a mandril so as to turn true without any wabble. The lathe is run at a low speed, and the T-rest placed rather high near the top of the work, which is turned true with the common square graver held over-hand. The chamfered edge of the templates may form an angle of 90°. Every convex template should have its counterpart or concave; the steel plate to form this is clamped flat on to a face-chuck by a ring with two opposite screws tapped into the plate. The inner circle is turned out with a side tool, consisting of an old saw-file ground to a point on the three faces. The turning is continued till the disc or gauge just drops through; the inner edge is then chamfered from both sides.

Gauges below 1-5th of an inch in diameter are made from steel wire turned to the form shown in Fig. 7. The disc end is

Fig. 7.

hardened by heating it with the lamp and blowpipe, and quenching it in oil, and the counter-gauges are most easily formed by a counter-sink rose-bit run in the lathe. The plate of steel is chamfered out alternately from opposite sides, by forcing it up on the socket of the back centre, till the disc will pass through; the hollow templates are, of course, cut in half before they can be used.

An instrument for measuring the diameter of the discs, etc., is indispensable. It consists of a pair of sliding steel jaws, with a vernier and nonius capable of being read off to thousandths of an inch, and is sold by the watch tool makers.

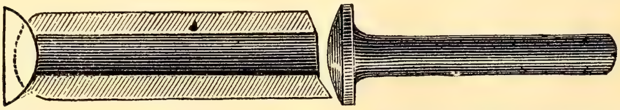
The moulds for grinding minute lenses are always of brass; they are also used in pairs. The concave is turned out to

gauge, and the convex to the counter gauge. For small radii the hard gauges are finally used for the last correction, as a turning, or rather scraping tool, and finished by grinding the two moulds together with the finest emery.

There is some difference in practice between the grinding of lenses for long and short radii. In the former, as for telescopes, the glasses are fixed, or have but a very slow rotary movement, and the concave tool is worked over them, either several at a time in blocks, or else, if a shallow curve is required, only on one single disc; this is placed in the centre, and a number of smaller pieces of glass planted round the circumference to support the figure, the whole being ground as one. But in the lenses to which this paper particularly refers, the concave tool is invariably caused to revolve rapidly, and the convex lens worked into it.

and tube ground and polished off together, as shown by Fig. 8 *b*, taking the same precautions as before to work the lens up to the exact diameter required. The end lines show the rough disc as cemented down. By this method all the marginal errors are taken up by the glass tube-holder, of which an assortment of various sizes will be required, from a minute bugle up to half an inch in diameter. Before using the holders again for other lenses, the end must be ground out on each occasion, so as to increase the diameter of the cup. The lens, when taken out by being warmed, will have a knife-edge perfect in the extreme.

In minute lenses, some difficulty will be experienced in obtaining the measurements by means of gauge instruments, when near the right diameter. I therefore, for small sizes, always use the microscope with micrometer eye-piece, hav-



b *a*

Fig. 8.

The same rules for guarding the extreme edges of lenses should be observed, as described in prism-work, shown by the following examples. Fig. 8 *a*, represents a plano-convex lens which has been made and finished upon a flat disc of glass, to which it has been attached with hard Canada balsam. The two discs are cemented to the stick with black sealing-wax; the lens and supporting disc are rough ground on the zinc plate till they nearly fit the concave gauge; they are then ground in the brass mould till the lens measures very nearly the diameter required, leaving a small allowance for smoothing and polishing.

For double convex lenses, the disc of glass, cemented on a stick as usual, is first ground and polished on one side. A piece of glass tube of suitable size is selected for a handle, and the end of the bore ground out to a similar radius; the polished side of the unfinished lens is then cemented into this concavity, and the lens

ing previously taken the exact size from the diameter of the cell in which the lens is to go. This is very accurate and convenient. After the finished lens is taken out of the holder, if it should be found too large to enter the cell, it may be slightly cemented to the end of a wire, and twisted into a piece of the finest emery paper, held in a hollow form, and the keen edge is taken off till it passes through.

The single fronts, for the highest powers, from their form, do not admit of being ground in this way. A piece of brass or steel is screwed into the mandril, and the end turned of a size to enter the cell into which the lens is to go; the end is turned flat, or rather slightly hollow, and the centre taken out. A piece of crown-glass is cemented by its polished side to the flat end, with the best orange shellac, and turned with the diamond point till it nearly enters the cell. The last finish may be given by fine emery paper wrapped round a flat piece of hard wood. The ex-

treme end of the glass is then turned off flat, till it equals the thickness of the intended lens, from the apex to the flat, as measured by the jaws of the gauge; the lens is next turned off by the diamond to the curve required, as shown in Fig. 9;

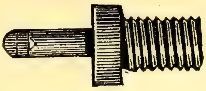


Fig. 9.

and, finally, the chuck is removed, and the lens ground and polished in the mould as usual. In all cases of cementing lenses on to chucks in this way, care must be taken that they are well pressed down, so that the layer of cement may be of the same thinness all round, otherwise the lens will be tilted and out of centering from unequal thickness. When taken off, the lac may be cleaned off with alcohol.

A similar mode of chucking is employed for a plano-concave lens. The polished flat side of the flint glass is cemented to the chuck, made just to enter the cell; but in order to appreciate the thickness in the centre, the circumference of the disc, after it is turned to fit the cell, is polished with a piece of hard wood and crocus. The concavity is then turned out a trifle deeper than the radius of the circular gauge till a mere line of light only is observable by looking through the polished edges. The chuck is then removed from the mandril, and the lens thereon ground and finished on the convex tools.

For a double concave lens, such as is used for a triple back, the end of the chuck, instead of being flat, must be convex, to match the radius of the concave surface of the disc of glass that it is to receive, this having been previously ground out and polished independently in the

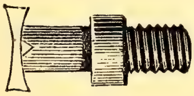


Fig. 10.

usual way of cementing it on to a stick; but as the curves are shallow, it is best not to turn the disc down to the intended size at once, but leave it much larger than the cell or chuck (Fig. 10), and after it is polished as before directed, the chuck is again screwed into the mandril, and the lens turned down so as to fit the cell; this is done in order to avoid the marginal errors which would arise from working a shallow curve of small diameter.

The same precautions have to be observed in smoothing lenses as directed for prism-work; the finest emery is used, and the requisite moisture applied as required by breathing on the lens, taking care that the accumulation of powder is removed from time to time from where the centre of the mould has been dug out, otherwise this may contain some coarser particles that may cause scratches.

As before remarked, the moulds are made in pairs; the convex and concave are turned to their respective gauges, and then ground together. The diameter of the mould should always rather exceed that of the lens intended to be ground; and the centre, or "pip," is taken out; unless this is done, a prominence is left at this spot, which injures the work. During the smoothing, the two moulds should occasionally be worked together, as this greatly tends to insure the accuracy of figure of the lens; and after this is completely smoothed, the moulds should again be matched, so as to leave them with a polished surface, for a reason to be hereafter explained.

Training Plants.

THOSE who have visited European gardens and pleasure grounds, must have been struck with the beauty of the trained plants, forming hedges and bowers, which form a prominent feature in the old homesteads. The wonderful skill shown in the culture and training of these plant marvels is surprising to those who are familiar with the vain attempts made in this country to grow live hedges. All along our country roads we see attempts to produce these live hedges, but in almost every case the result is a miserable failure. Although horticulture is not a subject to which we propose to devote much attention in these pages, yet since a nicely-trained hedge or arbor forms a pleasant work of art for our young

readers (whether boys or girls), a few words may not be out of place. And to show what may be done in this direction, we give an engraving of a remarkable specimen of ivy, cultivated and trained in a peculiar manner, and which was among the floral marvels at the Paris Exhibition of 1867. At that time the plant had a straight clean stem more than 6 feet in

TRAINED IVY PLANT.

height. The spread of the branches, when fully extended, would then have been between 32 and 33 feet, but they were trained in an arching manner, as shown, so as to leave an opening in the interior of about 23 feet in diameter. The branches were well furnished with leaves, and as the plant grew in a tub, it could be removed from place to place, and used as a pleasant summer-house. The facility of transportation was further increased by the fact that the branches were trained over wires, which could be folded up umbrella fashion.

Many similar tents might be made with other kinds of plants, such as Virginian creeper, common kidney bean, hops, and other plants that grow much quicker than ivy, but in that case, instead of a central stem, the pots containing them would have to be set on the outside of the circle, and the plants trained over a canopy formed of wire or wood work.

In training plants for bowers or hedges there are two points that specially demand attention. The first is cutting back or pruning. Most failures in hedge growing are due to the fact that the owners are afraid to cut the plant back. After a plant has made a fine growth, and has attained a height of six or eight feet, it seems cruel to cut it down to the ground. And yet this is just what must be done if we would have a hedge which is close at the bottom and free from gaps. The reason of this is obvious. The tendency of all plant growth is to the extremities of the branches, and if this tendency is allowed to develop, all the strength of the plant is drawn away from the buds near the roots, and they consequently die out, leaving nothing but bare poles. To form a good hedge we must have innumerable small shoots springing from near the ground, and not a few strong branchless stems.

The second point is that to enable the

plant to withstand this severe cutting back, the roots must be well-developed. Our climate is so dry, that unless the ground is deep the plants dry up and perish. The soil ought not to be too rich, but it ought to be very deep.

The same rules apply to the shaping of plants into bowers or arbors. A screen that will exclude sun and rain can be formed only by severe cutting, so as to produce a dense mass of fine branches.

Plaster Casts of the Face.

ALTHOUGH this is an art which is usually practiced by sculptors, and artists specially prepared for executing such work, yet it is not a difficult process and may be easily carried out by amateurs. The best way, according to *Stubchen-Kirchner* is the following: First anoint the hairs, eyebrows, and beard—if the latter is to be preserved—very thoroughly with pomatum or lard, until the hairs agglutinate, when they are to be arranged exactly as it is desired they should appear on the cast. All other parts of the skin are then oiled, and the head isolated from the rest of the body by suitably arranged cloths. A firm and well-waxed thread is now placed upon the head in such a manner that one half of it passes down the centre of the face, following the outline of the skin as closely as possible—and the other half passes over the back of the head, likewise closely following its contours. In the same manner another thread is passed over the head sideways, so that the whole surface is divided into four quarters. Good gypsum (dentist's plaster) is now mixed with warm water, the mass is allowed to become somewhat stiff, and then applied as quickly as possible by means of a broad brush, beginning at the back of the head and ending at the mouth and nose. In order to facilitate breathing, paper-tubes may be inserted into the nostrils, but, with proper care and skill, this is not necessary. Upon the first layer a second, of much greater thickness is applied with the hands, and just as soon as the plaster begins to set, the ends of the strings are grasped with both hands, and pulled outwards and upwards, so that the cast is divided into four parts. After a short time it will have hardened sufficiently to permit its being taken to pieces. The pieces are then dried and varnished. When using them for making a cast, they are placed in position and luted together with plaster. Direct application of a thick layer of fresh plaster to the skin of the dead often produces unnatural shrivelling of the skin, or twisting of superficial organs. To avoid this, it is best to apply first a very thin layer of plaster, then a number of strips of very fine cotton or linen fabric, and, after this first thin layer is dry, to apply a thick layer of plaster on top of the latter. The preparation of casts after the moulds are made is so simple that it needs no special description.

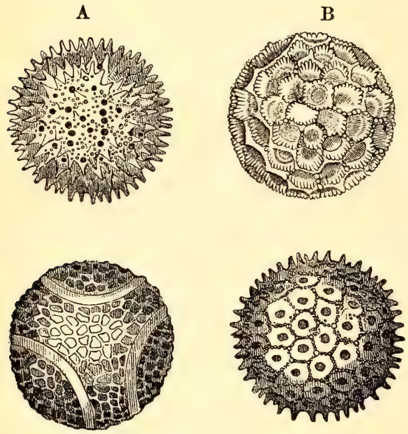
Pollen as Microscopic Objects.

THERE is scarcely any class of objects that yields more beautiful and more easily prepared specimens for the microscope than pollen and seeds Later in the season we hope to tell our readers of the beauties of the latter, but at present the gardens and fields abound everywhere with pollen, and we shall turn our attention to that.

To examine pollen under the microscope is not a difficult task. All we have to do is to shake a little on some smooth, dark surface, such as a piece of vulcanite or blackened paper, and examine it with a low or moderate power. The illumination must be good; good daylight answers well, but when we have to work at night we may get excellent results from the light of a good lamp condensed with a common condensing lens. The flowers of the hollyhock, the various lilies and other plants, all yield pollen differing widely in form, color, etc. It would occupy more room than we can spare to give the different appearances exhibited by the various pollens; we have selected four which will give a general idea of the beauty of this class of objects.

In the engraving the pollen marked A is from the Althæa rosea; B is that from Cobœa scandens; C from passion flower (Passiflora Cærulea), and D from Ifromæa purpurea.

While pollen requires little or no preparation for mere examination, it often puzzles the beginner to mount it so that it will retain its beauty. If we wish to keep it as an opaque object, it is necessary merely to dry it and mount it in a cell that is perfectly tight. The new wax cell is one of the best for this purpose, though the "cement cell," as it is called, is the most easily made and does not require any tools except the turn-table. The bottom of the cell should be made black, and this may be done either by pasting a piece of black paper on the under side of the



POLLEN GRAINS.

cell, or coating the bottom with some dark material—beeswax, colored black with very fine lampblack, being as good as any. The secret of success in preserving pollen in this way lies in thoroughly drying it, and a very excellent method is to take the whole anther, press it gently between sheets of soft, white paper, and dry it.

Pollen may also be mounted in Canada balsam, and for this purpose the balsam should be dissolved in benzole or ether, so that no heat may be required.

Those of our readers who have means for obtaining dark ground illumination, will find many of the pollens very beautiful when shown in this way. They shine like brilliant stars in a dark sky, and show their peculiarities and structure in a way that is wonderfully distinct.

Editorial Notes.

Complimentary if not Pleasant.

THE little book, entitled the "Workshop Companion," which we published last Fall, seems to have secured the complete confidence and approbation of the scientific and industrial press, for we find it copied everywhere, and we regret to be obliged to say, generally without credit. A recent issue of the *Scientific American* has a two column article on *Cements*, credited to some other journal. This article is the chapter on cements copied from our book *verbatim et literatim.* So, too, the Boston *Journal of Chemistry* quotes from the London *Pharmaceutical Journal,* an article on cements, which it characterises as "exceedingly valuable," and advises "all housekeepers, and those engaged in work in the industrial arts," to preserve the number of the journal containing it. Our readers will, therefore, be glad to know that they can have this article and many others of equal value, in very convenient shape by procuring the "Workshop Companion."

The article in question, contains much that is common property, but a very large part of it has been rewritten, carefully corrected, and the special circumstances in which the given directions are applicable are pointed out. Moreover, the introduction is entirely original with the author of the work. In slightly different form, it was published in the first volume of the *Technologist,* and has been probably quoted and stolen by more newspaper writers and book-makers than any other article within our knowledge.

Such general quotation and praise is certainly very complimentary, but would be more pleasant if accompanied with proper credit.

—Wood can be ornamented by punching down carefully in patterns, planing off a little, and then wetting; the parts punched down show in relief above the planed surface and make quite a puzzle.

Astronomy for Amateurs.

BY BERLIN H. WRIGHT.

(Calculated for the Latitude of New York City.)

THE PLANETS—JULY, 1880.

	D.	*H.*	*M.*	
Mercury sets	2	9	2	evening
" "	5	8	59	" *
Venus rises	10	4	37	morning
" "	30	5	22	"
Mars sets	10	9	21	evening
" "	30	8	33	"
Jupiter rises	10	11	30	"
" "	30	10	14	"
Saturn "	10	11	59	"
" "	30	10	43	"
Uranus sets	20	9	14	"
Neptune rises	20	11	59	"

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS FOR JULY 21, 1880.

	H.	*M.*	
Alpha Andromeda (Alpheratz) rises	8	10	even
Omicron Ceti (Mira) variable "	0	28	morn
Beta Persei (Algol) " "	9	50	even
Eta Tauri (Alcyone or Light of Pleiades) rises	0	14	morn
Alpha Tauri (Aldebaran) rises	1	33	"
Alpha Aurigae (Capella) "	10	46	even
Beta Orionis (Rigel) rises	3	40	morn
Alpha Orionis (Betelguese) rises	3	25	"
Alpha Canis Majoris (Sirius or Dog Star) invisible.			
Alpha Canis Minoris (Procyon) rises	5	15	morn
Alpha Leonis (Regulus) sets	8	45	even
Alpha Virginis (Spica) sets	10	41	"
Alpha Bootis (Arcturus) sets	1	25	morn
Alpha Scorpionis (Antares) in merid	8	21	even
Alpha Lyrae (Vega) in merid.	10	32	"
Alpha Aquillae (Altair) in merid.	11	44	"
Alpha Cygni (Deneb) in merid.	0	40	morn
Alpha Pisces Australis (Fomalhaut) rises	10	50	even

NEAR APPROACH OF MOON TO PLANETS AND STARS, AND OTHER PHENOMENA.

July 1. Saturn 8° South of Moon.
" 2. Uranus 6° " "
" 3. Moon midway between Pleiades and Hyades.
" 3. Earth furthest from Sun.
" 4. Venus 9° in Gemini.
" 4. Moon Perigee: Tide Highest.
July 4. Moon Highest.
" 3–6. Mercury brightest, being at greatest eastern elongation; 26° 19′. An evening star.
" 6. Mercury at descending node.
" 7. Moon about 5° South of Castor and Pollux.
" 7. Venus very close to the moon, being only about one degree north.
" 7. Eclipse of the Sun; Annular, invisible in North America. Visible principally South of the Equator in South America and Atlantic Ocean.
" 9. Mercury 3° North of Moon.
" 9. Jupiter 90° West of the Sun; quadrature
" 10. Moon 3° North of Regulus.
" 10. Mars 5° North of Moon.
" 11. Mars 26° in Cancer.
" 11. Uranus 6° "
" 14. Moon 2° South of Spica Virginis.
" 14. Venus, Superior Conj. with Sun.
" 18. Jupiter 19° in Pisces.
" 18. Moon Lowest.
" 18. Moon 2° North of Antares.
" 19. Moon in East Branch of Milky Way.
" 20. Moon Apogee—tide lowest.
" 20. Saturn 90° West of Sun; quadrature.
" 24. Venus in Perihelion.
" 25. Saturn 27° in Pisces.
" 26. Uranus 10° in Leo.
" 27. Jupiter 6° South of Moon.
" 28. Saturn 8° " "
" 29. Uranus 6° " "

*Mercury will set on the 5th, 1h. 26m. after the Sun, near the close of evening twilight and at a point 23° 47′ north of the west point, and 6° 53′ north of the sunset point. He will appear much as a first magnitude star; as Antares. He is near the middle of the constellation Cancer, and there are no stars in his vicinity bright enough to be mistaken for him.

THE MOON, III.

Mount Taurus (51) is a lofty range of high mountains, in which is the terraced crater, Rœmer (52), which is 26 miles in diameter, and 11,600 feet deep.

About six days after New Moon, Posidonius (54) makes a good object. This is a walled plain 62 miles across, including several small objects, in which changes have been observed by several astronomers. Mount Argœus (58) is a small range rising towards the East to a summit upwards of 12,000 feet high. It is remarkable for the spire of shade which it casts across the plain at sunrise. It requires close watching, as the shadow rapidly looses its slender point. It is best seen 4d. 21h. after New Moon. Macrobius (59) is an isolated crater, nearly 13,000 feet deep, and north of it is Proclus (60), whose ring is one of the most luminous portions of the Moon; best seen a few days after Full Moon. Plinius (61) is a terraced ring 32 miles broad, and filled with hillocks.

Menelaus (70) is the common radiant of several bright streaks. This is a steep crater 6,600 feet deep, and was declared an active volcano by the elder Herschel, but this was refuted by other

observers. It is quite probable that Herschel was correct in his surmise, as there is abundant proof of activity quite near this spot. 70 is very bright at Full Moon, and the surrounding bright streaks may be seen extending out into Mare Serenitatis (H), a nearly circular plain, 430 miles in diameter. Near its west edge is a low serpentine ridge, which may be best seen five or six days after New. Upon the south boundary of H is the grand mass of mountain peaks called Caucasus (75). The peaks tower as lofty as any on the Moon, reaching as high as 19,000 feet. Their narrow shadows are drawn out into fine points, forming a grand spectacle in the First Quarter.

Eudoxus (77) and Aristoteles (78) are a noble pair of craters, not easily seen at full, as the region is then dotted with thousands of bright specks. The terraced wall of 77 rises 11,300 feet above the west interior, and is crowned on that side by two turrets 15,000 feet high. 78 is more than 50 miles broad, and nearly as deep as 77, but with a much richer wall, being very remarkable for the rows of minute hillocks, which nearly surround it in lines, pointing to the centre of the crater; the finest specimen of this not uncommon arrangement. This same arrangement may be seen around 77 also, in the First Quarter. On the S. and S.W. of 77, down to Mare Serenitatis and the Caucasus, the surface is crowded with innumerable hillocks, like stars in the most crowded part of the Galaxy.

Penn Yan, N. Y.

Filing Flat and Other Surfaces.

THIS is one of the branches in which, as a rule, most amateurs fail, and failure is not confined to them, as it is one of the most difficult operations which the professional engineer has to perform. I think, therefore, a short practical article will be acceptable to many of our readers, and it will be my endeavor to make my remarks as concise as possible, and to convey as much information as space will admit of. First, then, as to the selection of files. This must, of course, depend entirely upon the nature of the material about to be worked. As to the various shapes and forms that are to be filed, these we will leave alone, *pro tem*, and be contented with trying to file a flat and true surface. This accomplished, whoever the person may be, he is entitled to consider himself a good vice-man, it being well known that this is one of the greatest difficulties connected with this particular art. Having selected a piece of brass to begin upon, about 2½ inches square, take a 10 inch bastard file One reason why I suggest brass to begin upon is that when the file is worn too much for brass it will be in good condition for steel or iron. Economy with files must form one part of the workman's education in filing. Some men will wear out twice the quantity of files that another will, and it is only because the one is careful and the other is utterly regardless of the files, simply because he does not have to pay for them. Before beginning operations, another important matter to attend to, is the fixing of the vice, and this should be so arranged that when the work is held in it, the surface to be filed will come to an elevation just below the elbow. Like many other things, there is a slight diversity of opinion as to the exact height it should be held. Some advocate the work being level with the elbow. I think it will be better for the workman to so adjust his work as to suit his own comfort, regardless of its being an inch above or below any given point. It may appear to some a matter of little or no consequence how a man stands in position when at the vice, but this is to me one of the best tell-tales of a good workman. Nothing is more objectionable to an experienced man than to see a fitter with, it may be, his left foot two feet or more from his vice, or, on the other hand, leaning against the bench and using two inches only out of a ten inch file. To be an efficient vice-man position must not be overlooked. The left foot should be about six inches from the bench, and the heel of the right between 30 in. to 36 in.; the left knee slightly bent forward, the elbows kept well into the side, and in taking the forward stroke, the weight of the body should go with the bend of the knee. As to the distance given for the feet, a deviation may be necessary in many cases in consequence of difference in the height of various men. But a few strokes of the file will soon show if the position is suitable. The file must be firmly held in the right hand, and the left hand should bear upon the front end of it, as the file must only be allowed to cut one way, that is, forward. The pressure must be relieved when it is drawn back; if not, much damage will be done to the file, in the way of breaking off the teeth. I have many times had men come to me with a file, and assert that it was of no use, being too hard, causing the teeth to break. Even so-called practiced hands have done this, but the cause of this has been not knowing now to use the tool. Nothing but long practice will enable any one to arrive at any state of perfection. In holding the file firmly in the right hand, it must not be clinched so that the wrist becomes cramped, but sufficiently rigid not to allow the file to turn all ways. The action must be a natural one, and the movements backwards and forwards be in a horizontal direction. After several trials, it may be found the same result has been obtained, that

of the work being rounded off at the ends, sides, and anything but flat. No matter; all the expressions of regret at this result, occurring so many times without any improvement, will not alter matters. Patience and practice are all that the tyro at the vice requires, and after a certain time he will find, probably to his surprise, that the piece he is filing is inclined to favor him by becoming something approaching flat. This is encouraging, and fresh vigor is instilled into the man, file, and apparently material, as a certain amount of improvement is evident at each successive trial. And I think that if, after a few months, for it will not be properly instilled into any one in less time, whoever tries can then feel certain of performing this feat of filing a flat surface, he will be well repaid for the time and study he has devoted to it.

To be Continued.

Labelling Bottles.

A writer in the *English Mechanic* says: "There is no plan so good as one I use. Affix a common paper label and let it dry; then heat the label (by a Bunsen burner or very small flame) till it will just melt paraffine rubbed on it. The label is absolutely protected, and looks as if it were enameled on the glass. If the neck and lip of the bottle and the stopper are similarly treated, a perfect air-tight joint is secured and the stopper never sets, while liquids can be poured out without running down the sides."

Practical Hints.

Case-Hardening.—If a surface case-hardened with prussiate of potash appears of a dirty black, it is because it has not been properly done, for a prussiate of potash, well-hardened job, is white, without a single shade of black anywhere, and is quite as hard as any case-hardening.

Again, any form of hardening that leaves the surface otherwise than white, does not thoroughly harden, or, in other words, the fancy colors on such work evidence that it is only partly hardened, and, as a rule, can be cut by the edge of a sharp smooth file, if well-pressed to the work.

These are facts none too well known, and just the points that your paper can do a world of good in bringing out.—*Blacksmith and Wheelwright.*

Cleaning Brass.—The following directions have been given by a correspondent of the *Artizan* (London):—Make a mixture of one part common nitric acid and one-half part sulphuric acid in a stone jar; then place ready a pail of fresh water and a box of sawdust. Dip the articles to be cleaned in the acid, then remove them into the water, after which rub them with sawdust. This immediately changes them to a brilliant color. If the brass is greasy, it must be first dipped in a strong solution of potash and soda in warm water. This cuts the grease so that the acid has the power to act. This is a government recipe used in the arsenals. We will add to the above recipe that first washing in clean water, and second in water in which aqua ammonia has been placed to neutralize all trace of the remaining acid upon the surface of the brass, is an improvement upon the above process, which is in all other respects, a good one. After dipping in the ammonia water and cleaning in the sawdust, if a good quality of lacquer be used, the effect is very fine. This process is excellent in preparing brass labels stamped from thin sheets.

Flower-pots in the Laboratory.—A flower-pot makes an excellent lamp screen, for steadying and concentrating the flame under evaporating basins, etc.; of course a sufficient interval must be kept between the pot and the basin, else the light will be extinguished.

A small flower-pot with wire gauze tied over the top is a very effective low temperature lamp when the gas is lighted below the gauze. If the gas is lighted above the gauze we have a capital argand lamp giving a large, clear blue flame. In the latter case a common burner can be used, a consideration when Bunsen's are all temporarily occupied or not available. After a time the pots become cracked from the heat, but as they are easily replaced this does not matter, and even when cracked they will often hold out for a considerable time. Fireclay flower-pots made rather thick would, however, afford a really good and cheap portable furnace.

By placing the flower-pot inside another just large enough to encase it, loss of heat by radiation would be effectually checked.

To Pulverize Shellac.—Any one who has tried to pound up shellac in a mortar knows that the attempt is more favorable to perspiration and profanity than to the pulverization of the slippery stuff. A correspondent of the *Druggists' Circular* has devised the following method: "Enclose the shellac in a strong, closely-woven piece of cloth, at first compressing the folds rather tightly, but gradually relaxing them. Then, after placing the bunch, which must be held in position with the hand, upon a solid block or smooth counter, the strokes of a heavy iron pestle are applied, gently at first, while the bunch is kept mov ng from side to side, so as to expose every part to the strokes of the pestle. After the large, sharp pieces are broken, the strokes are increased in velocity and power, with wonderful effect upon the resin, and but little injury to the cloth. In this way shellac may be reduced to a granular form sufficiently fine for pyrotechnic purposes at very short notice, and to an almost impalpable powder in a comparatively short space of time. To produce this result, however, it is necessary to wield the pestle forcibly, and then from time to time separate the finer particles from the coarser by sifting."

EXCHANGES.

Wanted, "Butler's Family Aquarium;" will give in exchange two books, entitled "Laughing Gas" and "De Walden's Ball-room Companion." E. R. Brown, Box 25, Covington, Ind.

A small printing press and outfit, cost $12, for steam engine, Demas lathe and scroll saw, or offers. Ernest Corthell, Rockport, Maine.

A patent spectograph, cost when new $1.25; rare minerals, birds' eggs, and postage stamps, to exchange for minerals, foreign coins, Indian relics, or offers. Frank F. Fletcher, St. Johnsbury, Vermont.

Eggs, of the English sparrow, for good specimens of other birds' eggs; botanical specimens mounted and unmounted to exchange; lists exchanged. C. R. Hexamer, New Castle, Westchester Co., N. Y.

Two telegraph instruments, nearly ½ mile of wire, one battery; also 4 in. magnet, 8 Scientific American Supplements, full of information; new history of United States; a $4 German silver-trimmed flute; what offers? Ewing McLean, Greencastle, Ind.

Wanted, The Workshop Companion; I have Gaskell's Compendium, $1; The Round-of-Months, 75c.; Amateur's Hand Book, 15c.; also books, papers, pictures, etc.; send lists of what you have to exchange. W. B. Moore, Morgan Station, Ky.

McAllister's magic lantern and 30 pictures (cost over $95), to exchange for job type and material, or a good microscope and specimens; $20 worth of novels for a good $15 or $20 household microscope; rare mineral and Indian relics for exchange or sale; refers to editor. John T. Patrick Wadesboro, N. C.

What is offered for one of the Climax extension step ladders? H. E. Phelps, Manhall, Michigan.

Wanted, a good microscope in exchange for a scroll saw; instrument must be in good order, and magnifying power of from 200 to 300, or 400 diameters. H. E. Rhodes, Brighton, Iowa.

To exchange, a $3 microscope for some old issues of Canada postage stamps. Wallace Ross, Lock Box 97, Rutland, Vt.

Wanted, a printing press; have for exchange a good microscope (Smith & Beck, London), 3 object glasses, and three eye pieces, power from 15 to 600 diameters, original cost $60; books, chemicals guitars, and other things for exchange. E. F. Underwood, 9 Murray St., N. Y.

Wanted to exchange, Colorado minerals, such as jasper, smoky quartz, silicified wood, etc., for good specimen fossils, or perfect crystals of minerals of other localities. H. F. Wegener, Denver, Colorado.

One Natural Philosophy, one Bryant & Stratton's Counting-house Book, and two long bows, with arrows, to exchange for cabinet specimens or curiosities. W. D. Wright, Lock Box 17, Bremen, Indiana.

Wanted, coins, minerals, and type; send lists of what you have and what is wanted in exchange. A. Campbell, Derrick City, McKean Co., Pa.

An Excelsior Printing Press, with equipments, comparatively new, cost over $47, for double barrel breech-loading shot gun, with reloading tools and shells. William A. Hervey, Box 134, Taunton, Mass.

To exchange, 400 stamps, all different, in a stamp album, for a small printing press with type, etc. Arthur D. McGerald, 106 Bird Ave., Buffalo, New York.

Revolver, microscope, microphone, 4 magnets, skates, skate sharpener, copying pad, books, magazines, $7 worth of rosettes, and lots of other things to exchange; I will give you a better trade than anyone else can. Chas. T. Conover, Esperance, Scho. Co., N. Y.

To exchange, $5 pair of telephones for mounted microscopic specimens, good objective, lathe chuck, watch, type and cases, or offers; describe offers. Wm. R. Brooks, Phelps, N. Y.

What offers for Roger Scroll Saw, 55 large patterns. J. Brower, 3,150 Frankford Road, Philadelphia, Pa.

Photographs of ten of the most influential Indians of Spotted Tail Agency, including Spotted Tail and family and four oil chromos, very beautiful, for printing press, scroll saw, or offers. Luther Emerson, Creighton, Knox Co., Neb.

"Appleton's Picturesque America," never been read or handled, value $24; "Dana's Mineralogy," $10, and coins, to exchange for a breech-loading shot gun, Winchester or Evan's rifle, or offers. D. M. Fuller, Box 115, Camden, Maine.

Scroll sawing outfit, $6; microscope, $3; pocket telescope, $1; Gaskel's Compendium, $1; Williams' Complete Painters' Guide, $2. What offers for all or part; printing outfit preferred. F. W. McNair, Box 46, Fennimore, Wis.

$7 worth of books or papers, to exchange for a Household microscope or offers. Jonas D. Rice, 221 Academy St., Mercer Co., N. J.

One pair best steel climbing irons, handsome seven shot, 22 calibre revolver, full nickel plate, ten dollars worth of boys' papers, and magazines, for works on natural sciences or offers. W. M. Stribling, Circleville, Pickaway Co., Ohio.

Idaho cabinet minerals, books, revolver, stencil outfit, an electrizer, for well-bound books of travel, biography, history, science, masonry and others of an instructive nature. J. P. Clough, Junction P. O., Lemhi Co., Idaho.

Dumb bells of all sizes, to exchange for most any thing; send for circular containing weights of them to J. P. Donohue, Box 7, Davenport, Iowa.

Wanted, scientific books and papers, microscope, drawing instruments, telephone, stamps and coins, in exchange for scroll saw, type, cards, revolver, shot gun, magazines, scientific books, or almost anything. W. L. Goodsell, Bath, N. Y.

A pair of New York Club skates, worth $3.50, also coins, minerals and postage stamps, for books or offers; correspondence invited. E. F. Greene, P. O. Box 889, Bath, Steuben Co., N. Y.

A nice marine oil painting, ready framed, worth $5.00; state what is offered in exchange. C. Hammond, Artist, P. O. Box 47, Chatham, Barnstable Co., Mass.

Photographic camera, one portrait and one landscape tube, with chemicals complete, in exchange for medical books. J. Frederick Herbert, 1,324 Poplar St., Philadelphia, Penn.

What offers for 1 Household Microscope, one 8 shot breech-loading carbine, 1 new 7 shot pistol and cartridges, 1 small gold watch, 1 small gold chain, 1 violin and case, one new darning machine. Lock Box 147, Tarboro, Edgecombe Co., N. C.

Back Nos. "Penman's Art Journal" for 1879; Gaskell's Compendium, $1; Coe & Shells' Pen and Ink Drawing, 25c.; Pettengill's Fortune Teller, 40c.; Hand-Book of Business, 25c.; in exchange for microscope, printing press, or offers. M. B. Moore, Morgan Station, Ky.

Trump's and Russel's scroll patterns, worth $10; for large lenses preferred. H. J. Peters, Rogersville, Ohio.

Lessons in Standard Phonography given in exchange for a printing press, lathe, scroll saw, scientific books, hammock, or offers. Phonographer, Box 331, Topeka, Kans.

Wanted, chemical apparatus, in exchange for "Phrenological Journal," $2, and the last six numbers of "American Agriculturist," 75 cents, of 1879. T. P. Potts, Canonsburg, Pa.

Land and fresh water shells, birds eggs, minerals, fossils (correctly named) or books, Gray's "How Plants Grow," Pope's "Linear Perspective Drawing," in exchange for a Multum in Parvo

The Young Scientist

SCIENCE IS KNOWLEDGE. KNOWLEDGE IS POWER.

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A PRACTICAL JOURNAL OF

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A Snapper's Home.

BY A. W. ROBERTS.

WITH the assistance of a companion, I had constructed a pond in one of the sunken lots that adjoined the old homestead. The bottom of this pond was puddled with clay to make it as near water tight as possible. The margins were ornamented with masses of rock, with here and there patches of pond lilies, sweet flag, and cat-tail. Near the centre was an island, which went by the name of the "Snappers' Home." It was a pretty spot, built up of odd-shaped stumps of trees and rocks, the spaces between them being filled in with the richest of black peat, in which ferns, lilies, and semi-aquatic plants were planted. This pond was stocked with gold fish and all the various kinds of reptiles that could be procured, and, boy like, those animals that made the most noise were our favorites.

To the south of where now is situated Myrtle Avenue Park, Brooklyn, at the time this pond was constructed, existed a large swamp that teemed with animal life. It had been an unusually hot summer, and the ponds for miles around were drying up, causing the turtles, frogs, snakes, and aquatic insects to leave them and take up their quarters in this remaining piece of water, so that if the dry spell lasted, and this swamp dried down to the "last ditch," things would become very lively. Anxiously I watched and waited each day, the water becoming lower and lower, and thicker from being constantly stirred up by the thousands of distracted animals.

At last, when the water was reduced to a comparatively small space in the lower part of the swamp, I determined to make my first haul. Provided with a bag into which the frogs were to be imprisoned, and a long-handled scap net to capture them with, I reached the swamp an hour after daybreak; at this time of the day the

frogs were mostly on the margin of the swamp, and easy to capture, so that I soon had all the bag would hold.

When resting, before starting for home, my attention was attracted to the pond by a large black and pointed object moving irregularly about upon the surface of the water—forward, sidewise, backward, then disappearing, only to reappear at the lower end of the pond, and so it kept on restlessly moving about. I could stand it no longer; so taking off my shoes and tying the bottoms of my pants over the tops of my stockings—for the horse leeches and boat flies had got to be mighty thick in the water the last few days—I started in search of this new wonder. Taking advantage of the bushes that margined the pond, that my approach might not be observed, I got within a hundred yards of the mysterious object; entering the water I began to move slowly and silently towards it, when it went under. Instantly I dashed to the spot from whence it had disappeared, judging that so large an animal as this must be would leave a trail or track behind it from stirring up the muddy bottom; in this I was correct, for extending from the place where I had last seen him, stretched a broad black and peaty track. Following this rapidly, I soon had the pleasure of knowing that I stood directly over the moving object, but I didn't dare grab it when under the water, not knowing either its size or nature. Presently it ceased moving, and on the surface appeared a small black and pointed object, with two small holes in it; in an instant it disappeared under the surface, and began moving along the bottom very rapidly, stirring up great clouds of peat. It had scented me and was alarmed. I still followed it closely, till it paused once more, and moving to leeward of it I scrouged down close to the surface of the water that it might not scent or see me. Again the small black speck appeared, gradually protruding upward from the surface, higher and higher, till it extended some six inches, and moving cautiously around, it reconnoitered the entire pond with its small, villianous-looking black eyes. For a few minutes we each remained motionless, and after a careful inspection I concluded that I was on the track of one of the most powerful, active, cunning, and wicked of all reptiles that inhabit fresh water, the *Chelydra serpentina*, or "snapper."

There was only one way to capture him, and that was to seize him when under water; a rather dangerous proceeding, for if he once closed his powerful jaws on me nothing would cause him to lose his hold (absurd as it may seem, it is nevertheless true that the head of this turtle, after being cut off, will retain sufficient vitality to maintain a firm hold upon the object seized for several hours). Knowing, by the young specimens of this variety of turtle that I had kept in aquaria, that when in motion their tails dragged behind them, and that if I could find exactly the position of this fellow's tail, and once get a good hold of it with both hands, I could pull him to the shore and thus secure him for my pond. Following in his wake once more, I cautiously felt for his tail with my foot, not liking to give him a chance at my arms or hands in case we came to close quarters. The water being thick, he could not see my foot, and I touched him so carefully and lightly that he paid no attention to me. His tail seemed to be enormous, and of a rough horny texture, extending a considerable distance out from his shell. Seizing him with both hands, I was dragging him towards the shore, as I did not dare lift him out of the water, not knowing his weight and fearing he might turn on me, when he fastened on an old root with his fore feet and held fast. I braced back, and was pulling with all my might, when he let go his hold, and, my feet slipping from under me, we both lay sprawling and splashing in the water. In an instant I regained my feet, still holding on to his tail, and gaining the shore, dragged him to a newly-plowed field, where I knew he could not get away from me. When I let go of him he rose up on his four feet and lunged at me, at the same time opening his mouth and snapping at me savagely with his sharp jaws. He was a very fine specimen, and weighed some twenty pounds.

My next anxiety was to secure him so that I might take him home for the pond.

I did not dare approach him, he being so watchful and quick in his motions. At last I bethought me to cover him over with sod and stones; this took me some time to accomplish. Then taking off my suspenders, and making a slip noose at the end of them, I proceeded to dig down through the sod till I reached one of his hind legs, to which I secured the suspenders, by which I dragged him to the nearest farmhouse, when I fastened him in a large box, and arranged with the farmer to deliver him to me next day.

When he was placed in the pond he took immediate possession of the island, remaining there all the season. To prevent his foraging on the inhabitants of the pond I fed him bountifully on raw beef, with now and then a fish or dead frog, also the stems of water lilies, of which he seemed very fond; still I think he never felt happy, as he had a way of making a subdued and smothered bellowing noise, as if calling for his mate. From this swamp I stocked my pond with hundreds of frogs, lizards, aquatic insects, and their larvæ.

The young of the snapping turtle, if very small, is one of the most interesting of all the reptiles for an aquarium, but he must be fed *regularly* and *bountifully*. In course of time he will learn to feed from your hand, and will allow you to take him out of the water and handle him. I have had them so tame that they would sit in the palm of my hand and feed, tearing the food in pieces with their sharp claws. When young the shell is very soft, but in a few months begins to harden.

The female snapping turtle deposits her eggs about the latter part of May, some distance from the shore, where she digs a deep hole in the sand or loose earth with her powerful fore feet. All the eggs are deposited at one laying, and are covered over with loose earth, dry leaves, and grass, and are left to hatch out as best they can. Skunks and weasels are particularly fond of turtle eggs, and devour large quantities of them. The young take to the shallow water as soon as free from the egg, feeding on aquatic insects and larvæ, to which they are very partial.

Prof. Agassiz says, in his "Contribution to the Natural History of the United States": "The snapping turtle exhibits its ferocious nature even before it leaves the egg; before it breathes through lungs; before its derm is ossified to form a bony shield; nay, it snaps with its gaping jaws at anything brought near. Though it be still surrounded with amnion and allantois, and the yolk still exceeds in bulk its whole body, I have seen it snapping in the same fierce manner as it does when full grown, at a time when it was a pale, almost colorless embryo, wrapped in its fœtal envelope—three months before hatching."

The snapper is a long-lived animal, their growth continuing during the entire period of their existence. Snapping turtles used to be quite plentiful, but are now becoming more scarce every year, from the fact that large numbers of the young are taken every year by collectors for aquaria. And the large-sized ones are sold to fish dealers, from whom they are purchased for the purpose of making "terrapin soup."

Next to a snapping turtle, for an aquarium, is the beautiful "painted turtle" (*Chrysemys picta*), which is still abundant in all ponds and ditches. It has none of the ferocious nature of the snapper, but is of a mild and timid nature, easily petted, very active and inquisitive, and an excellent swimmer. I have had them so tame that they would come to be fed at my call, allowing me to handle them freely, and seeming to be delighted when I gave them a hot sun bath. The name of painted tortoise is derived from the fact of its shell being ornamented with such rich and intense contrasts of color. The margins of the under shell and legs being loaded with a deep rich vermilion color and olive brown. Its head having bright yellow markings along the sides, and the plates of the upper shell being slightly margined with a dull yellow. This and the young of the snapper are the only two kinds of turtle that I can recommend for fresh-water aquaria, but they must always be very small. All dealers keep them in stock. The spotted or mud turtle, and musk or stinking turtle are inactive, and, refusing food, soon die. When turtles are

kept in aquaria, the rock work should extend well above the surface of the water, and in that part of the tank that receives the most sunlight, so that they can rest and bask at their pleasure. The best food for turtles is plenty of lean beef. A good way is to hang a small piece in one corner of the tank so that they can help themselves; if well fed they will not molest the fish.

A Home-Made Bouquet Holder.

THE pretty little bouquet holder which we have figured in the accompanying engraving, is made out of very common materials, and requires no great skill nor any elaborate tools. The holder itself is merely one of those glass balls which marksmen employ for shooting at, and the base is a wooden cup, which any smart boy that has one of the common little cheap lathes will find no difficulty in making. A sound piece of beech or maple, large enough to make the base, should be screwed on to the spindle of the

BOUQUET HOLDER.

lathe and roughly turned up to shape. The cup is then turned out and finished smoothly inside, after which the outside is turned to the exact size and carefully finished and polished. The polishing is done in the lathe, and is quite easy, as the high speed that we can give to the wood makes it polish very easily. A little good shellac varnish is the best material.

The mouth of the holder is also turned out of wood, or it may be fashioned out of sealing wax. If the ball be gradually heated until it is warm enough to melt the wax, the latter will adhere quite firmly, and may be easily moulded by the fingers into any shape.

If the upper edge of the wooden cup is scalloped, as shown in the figure, its appearance is greatly improved. The scalloping is readily done by means of a penknife. While the cup is in the lathe, make a very light mark on the inside, and as far from the edge as the scallops are to be deep. Then mark the scallops out carefully with a pencil, and cut them with a penknife. The edge may be finished with a fine file and the very finest sandpaper.

Glass Engraving.

BY A. G. M'KEAN.

ONE of the most interesting and useful operations with the foot lathe, is that of engraving on glass. The tools required, beside the lathe, are few and inexpensive, comprising several sizes of copper wheels, from 1-32 inch to 1-2 inch in thickness, and from 1-8 inch to 3 inches in diameter. A great variety of work may be done with these sizes, but the larger the assortment the better. They should be attached to the lathe spindles in any convenient manner, but it is best to attach the larger sizes by means of a screw thread, and the smaller sizes by means of a chuck.

The periphery of some of the wheels may be beveled, some rounded, and some made square across.

When all is ready, apply some flour of emery, mixed with a little olive oil, to the periphery of the wheel, and at the same time revolve it slowly. Now bring the glass in contact with the wheel, when it will be found to cut. Should the wheel cease to cut, apply more of the oil and emery.

In engraving letters, the letter to be engraved should be laid on the glass with a mixture of gum-water and whiting, by means of a pen or camels-hair brush.

The amateur must learn, by experience, which wheels to use, the larger ones being used for straight lines and large curves, and the smaller ones for small curves. It will surprise the amateur how quickly

and easily one may acquire proficiency in the art.

Precious stones are cut in the same way, except an iron wheel is used instead of a copper one, and diamond dust instead of flour of emery.

Fern Pictures.

A SIMPLE photographic method of making fern pictures is thus described by the *Chemist and Druggist:* Cover a sheet of paper with a weak solution of salt in water and some white of an egg, well beaten; after it is dry, take it into a dark room, and with a tuft of cotton pass over it a solution of nitrate of silver (50 grains to an ounce of water); dry it in the dark, and the coat of chloride of silver formed on its surface will receive the impression. Then arrange your ferns between two plates of glass, and cut the paper to the same size as the glass plates; place it under them and expose to the sun, in the same way as a photographer prints a portrait. Watch it until dark enough, and before removing the paper from the glass take it into a dark room. Here place the picture in a solution of hyposulphite of soda, which will dissolve the chloride of silver, but leave the decomposed material (finely divided black silver) which forms the black background, while the shadow of the leaves will be white.

The old method of *spray* or *spatter* work also gives very good results: Take a sheet of strong white paper, and with an atomizer pass over it a spray of very diluted mucilage, so as to obtain a very thin and slightly sticking film, which will make the ferns adhere of which it is desired to make the picture. The ferns and leaves must have been first pressed in a book, and after arranging them to suit your taste, cause them to lie as closely to the paper as possible; fill an atomizer with very diluted India ink, and blow a spray over the ferns, more or less in proportion as you want a darker or lighter shade. It is well to do this with intermissions, letting it dry a little, so as to avoid excess of moisture and possibility of running the liquid into drops. When nearly dry, but still a little moist, remove the ferns, which may be used over again several times, each time being arranged in different figures. Instead of causing them to stick with mucilage, however, it is best to fasten the ferns to the paper lightly with fine pins. The figure of the fern is left white on a grey ground, and the figure of the fern leaves may be greatly improved by veining them with a pencil.

For an atomizer use either the old plan of a brush drawn across a sharp edge, or over a piece of wire netting, such as a coal sieve, or use the method described in a fomer number of this journal.

Home-Made Telescopes and Microscopes.—VII.

ON THE PRODUCTION OF SPHERICAL SURFACES IN GLASS.

HAVING got our lens perfectly smoothed and figured, the next operation is the polishing. It is almost impracticable to perform this in the hard mould, and therefore various substances are employed of a less degree of hardness, in which the coarser particles of polishing powder may become imbedded. 1. For the larger sized lenses in microscope work, beeswax, hardened with some resin and finely-washed ochre, is very suitable, but for medium sizes this is too soft and yielding. 2. A mixture of shellac and washed putty-powder is therefore employed, which is very enduring. These are melted together and stirred diligently; the shellac is added until the whole arrives at the consistence of thick paste; and as the lac is apt to burn, to prevent this a lump of beeswax should be thrown into the mass. This does not actually mix with the other ingredients, but lessens the risk of spoiling the composition by overheating; when cool enough the mass may be rolled into sticks between two greased boards.

For the very smallest lenses, such as the fronts of a 1-25th and a 1-50th, the last composition is still too soft and fragile to maintain a true figure. The polishing mould is therefore, for these, made in the end of a rod of pure tin, which is cut out

into a nearly hemispherical cup by the appropriate steel gauge; the "pip" is removed with a needle-point.

The wax-polishing bed is turned out to the required radius, and finished by scraping with the steel gauge; but as the material is somewhat yielding, the lens soon plays to the mould and keeps its figure during the polishing.

The second composition is very hard and brittle, and does not yield at all, and as the body is composed of the hard oxide of tin, this would speedily injure the gauges if used as cutting tools. The method that I have adopted for forming the polishing moulds from this substance is as follows:—A lump of the material is fastened by heat into a ferrule, or hollow cup, running in the lathe; the end is then turned either convex or concave, and of a diameter suitable for the lens to be polished; the convex or concave mould, as required (which has been worked off at last near to a polish, as before explained), is then screwed on to a handle, and held in a flame till, when touched with the moistened finger, it hisses smartly; a morsel of tallow is then put on the rough-turned composition to prevent adhesion, and the hot mould worked and rotated over it in every direction till cold; when removed the polisher will have taken the exact form of the heated mould, and have acquired a fine polish. For either convex or concave lenses the "pip" is taken out as usual, and it is advisable to make a few concentric scratches in the polisher if of large diameter.

As the mixture of crocus and putty-powder, recommended for polishing, is apt to cling in these moulds if applied at once, I first use the putty-powder alone; this cleans the hard polish off the face, and the operation may then be continued with the mixture.

One great advantage of this composition for a polishing mould is the decided way in which it maintains a true figure; for, unlike any other of the kind, it undergoes a very slight degree of wear, so that the face is always kept clean; and any number of lenses of similar form and radius may be polished in the same tool without having to alter or mend the figure, and perfect accuracy is the result. The composition is now generally known, but Mr. James Smith is the original discoverer of it. For the last degree of polish I sometimes rub a thin layer of pure soft beeswax in the mould, and smooth it down to form with the now finished lens; then a small quantity of the very finest washed crocus is applied, and the lens worked therein for about one minute. The extra brilliancy of surface obtained in this way is quite appreciable and well worth the pains bestowed, as the operation is not continued long enough to run the risk of injuring the figure.

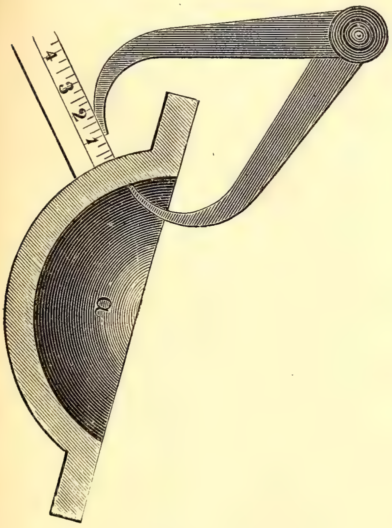
I have now only to give some directions for cementing the lenses together. The surfaces having been carefully cleaned, the two lenses are laid on a hot plate; a drop of Canada balsam is placed in the concave, the group of bubbles thrown up by the heat removed by a brass point; with this the convex lens (which is equally hot with the other) is lowered slantways into the balsam so as to avoid bubbles, and the two lenses are pressed together; they are now lifted off the plate with a pair of curved forceps held nearly horizontally, and shifted one-quarter round, and then dropped down again. This is repeated a number of times, and the two lenses being exactly of the same diameter, this operation must set them concentric as a matter of course. If the lens is a triple, the opposite surface of the concave must be cleaned, and the balsam removed with strong alcohol (turpentine must not be used as it percolates the balsam too easily, and is apt to cause bubbles to appear at the edges), and the same operation repeated as on the other side. When the lens is cleaned with alcohol, and examined edgeways with a magnifier, the three lenses will appear quite concentric, and should just pass into the cell without requiring any force; and if the workmanship has been correct—viz., all the cells turned true from one chucking, and the concaves of equal thickness and concentric with their respective convex lenses, no errors of centering can occur. The usual way of correcting this is by tilting the lenses in the cells in which they are

cemented with Canada balsam; but at the best this is only to some extent substituting one error for another.

Measuring Inaccessible Dimensions.

THE following ingenious "wrinkle," which we find in the *Millstone*, is by Mr. John Walker, of Baltimore, and will frequently prove useful to amateur mechanics. It is remarkable for its simplicity and the common want it so readily and accurately supplies. The practical mechanic is frequently at his wit's end to find dimensions in peculiarly difficult places, which no tool he may possess is fitted to determine.

The following illustration will serve to show how simple a thing it is to get the dimensions of any piece of work in whatever shape it may be. The casting in this



A NEW WAY TO MEASURE.

case being of spherical form, with flange, it would puzzle most mechanics without special tools to find its thickness. The first thing usually resorted to would be to drill a hole at a designated point. The above wrinkle provides a readier method, and does away with the application of special tools. By simply applying a common rule, as shown, and setting the caliper to some even inch on the rule, so that it may easily be removed, it will be seen that the difference between the even inch denoted and the actual opening of the caliper is the dimension required.

Bleaching and Dyeing Bone and Ivory.

IVORY is so frequently used by the amateur workman, and enters into the formation of so many instruments, that a good method of bleaching it is of great value.

M. Cloez being consulted by M. Gratiolet on the best way of removing the yellowish and fatty appearance of skeletons, as well as their unpleasant odor, advised the use of the solvents for fatty bodies, and especially the oil of turpentine. He was surprised to see not merely that the cadaverous odor disappeared in a short time, but that the bones became of a dazzling whiteness.

The same process applied to ivory gave a perfect bleaching. An exposure of three or four days to the sun in oil of turpentine is quite sufficient. An essential precaution is to support the objects to be bleached upon little supports of zinc, so that they may be raised a few millimetres above the bottom of the glass vessel in which they are placed.

Oil of turpentine is, in fact, a very powerful oxidizing agent, and it acts by reason of this property; the product of the reaction forms an acid liquid, which spreads on the bottom of the vessel in a shallow layer, and if the objects to be bleached dip into this acid liquid they become attacked.

The action of the oil is not only exerted on bone and ivory—it acts also upon woods and other bodies. Beech, maple, elm, yield excellent results, and cork is whitened very rapidly. Oil of turpentine is not the only one which possesses these properties; oil of citron and the other isomeric oils possess the same effect.

Ivory is easily dyed in different colors, but in order that the dye may be fast, the articles to be dyed should be previously steeped from six to eight hours in vinegar, or better, in a solution of alum. They may then be dyed a fine red by a decoction of Brazil wood; yellow with saffron

(!) or barberries; green with a mixture of three parts verdigris and one part sal-ammoniac dissolved in vinegar; and a fine blue by steeping them alternately in the above green bath and in potash lye. Black is obtained by alternate baths of logwood and black liquor.—*Moniteur de la Teinture.*

Gems and Precious Stones.

GEMS and precious stones always excite interest, not only from their great value, but on account of their exceeding beauty and the deep scientific interest which attaches to them. It is a wonderful fact that the diamond has almost exactly the same chemical constitution as the black lead which we use in our pencils, and the ruby and sapphire are merely pure alumina—an earth which forms a very large proportion of the soil which we till, and which, when out of place, we call dirt. A few words in regard to the principal gems may therefore please our young readers.

The *Diamond* is the hardest known substance, and one of the most unalterable gems. It is not affected by chemicals, is infusible, only to be consumed by exposure to a long-continued or very high temperature; and these qualities, combined with its rare brilliancy, make it the most valuable of precious stones. It is pure carbon ; chemically almost the same as graphite, or plumbago, and charcoal ; but very different from them in its transparency and lustre. It is generally found in octahedral crystals, having highly polished faces; and although possessing some beauty in this natural state, owing to the high lustre of the faces, yet it has not a tithe of the splendor exhibited by a well-cut brilliant. The ancients did not know how to cut the extremely hard diamond, and were content to wear it in its natural state, but even thus they prized it highly.

According to their transparency and lustre, diamonds are classified into stones of the first water, second water, and refuse stones. To be the first water a diamond must be absolutely colorless, very lustrous, and perfectly free from flaws. An undecided tint of any color injures its value; and although deep red, green, or blue hues may give the stones an exceptional value as fancy specimens, yet in the ordinary market they would be much less esteemed. A yellow tint always depreciates the value; and on this account many of the stones so recently found in South Africa bring very low prices. These African stones, moreover, lack the perfect lustre of Brazilian diamonds, and have, in consequence, commanded far lower prices.

A well-cut diamond, of the first water, is at present worth in New York about $50 gold, if it weighs half a carat (the carat being four grains Troy); if weighing one carat, $175; if two carats, $550. Above this weight the values depend on very delicate shades of difference. One stone of three carats may bring $800, another might be worth $1,000. Above three carats the price is only settled by agreement. A diamond of five carats is a very large stone, and above one hundred carats few are known.

Diamonds are found in alluvial deposits, from which they are separated by washing. In Brazil the work is done by slaves, and the fortunate finder of a stone of over seventeen carats receives his freedom and a suit of clothes. Scarcely one in ten thousand is found to weigh so much, and the majority of them weigh but a very small fraction of a carat.

The most celebrated localities in ancient times were Golconda and Borneo; but in 1727 the diggings in Brazil were opened, and yielded so abundantly as to greatly depreciate the value of diamonds, and the dealers tried to make people believe that they were not true diamonds. Lately diamonds have been found in Australia and South Africa, and a few in North Carolina, Virginia, and California; but Brazil furnishes the most abundant supplies and the best gems.

In our next article we shall tell our readers something about rubies and sapphires.

— The best rock-work for aquaria might be made of clay, such as is used for terra cotta, moulded to the required form, and baked quite hard, but not glazed. It might be colored of any tint before being baked.

Astronomy for Amateurs.

BY BERLIN H. WRIGHT.

(Calculated for the Latitude of New York City.)

THE PLANETS—AUGUST, 1880.

	D.	H.	M.	
Mercury rises	16	4	3	morning
" "	21	3	52	"
" "	26	3	55	"
Venus invisible.				
Mars sets	10	8	6	evening
" "	20	7	45	"
Jupiter rises	10	9	32	"
" "	20	8	51	"
Saturn "	10	10	0	"
" "	25	9	2	"
Uranus invisible.				
Neptune rises	20	9	58	"

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS FOR AUGUST 20, 1880.

	H.	M.	
Alpha Andromeda (Alpheratz) in meridian	2	6	morn
Omicron Ceti (Mira) variable rises	10	26	even
Beta Persei (Algol) " "	7	52	"
Eta Tauri (Alcyone or Light of Pleiades) rises	10	12	"
Alpha Tauri (Aldebaran) rises	11	31	"
Alpha Aurigae (Capella) "	8	59	"
Beta Orionis (Rigel) rises	1	42	morn
Alpha Orionis (Betelguese) rises	1	27	"
Alpha Canis Majoris (Sirius or Dog Star) rises	3	43	"
Alpha Canis Minoris (Procyon) rises	3	18	"
Alpha Leonis (Regulus) invisible.			
Alpha Virginis (Spica) sets	8	43	even
Alpha Bootis (Arcturus) sets	11	23	"
Alpha Scorpionis (Antares) sets	10	43	"
Alpha Lyrae (Vega) in merid.	8	34	"
Alpha Aquillae (Altair) in merid.	9	46	"
Alpha Cygni (Deneb) in merid.	10	38	"
Alpha Pisces Australis (Fomalhaut) in meridian	1	55	morn

NEAR APPROACH OF MOON TO PLANETS AND STARS, AND OTHER PHENOMENA, AUG., 1880.

Aug. 1. Mercury 6° South of Venus.
" 1. Mars ¼° North of Uranus.
" 1. Venus 17° in Cancer.
" 1. Moon Apogee; tide lowest.
" 1. Moon highest.
" 5. Mercury inferior conj. with Sun.
" 6. Neptune 90° West of Sun.
" 6. Venus 5° North of Moon.
" 8. Uranus 6° " "
" 8. Mars 6° " "
" 8. Jupiter stationary.
" 8. Mars 13° in Leo.
" 10. Saturn stationary.
Aug. 15. Mercury stationary.
" 15. Jupiter 18° in Pisces.
" 17. Neptune stationary.
" 17. Moon Perigee; tide highest.
" 20. Uranus ¾° South of Venus.
" 22. Mercury at Gr. Elong. West 18° 21′.
" 22-25. Mercury brighest—a morning star.
" 22. Saturn 26° in Pisces.
" 23. Jupiter 7° South of Moon.
" 24. Saturn 8° South of Moon.
" 25. Neptune 6° South of Moon.
" 26. Neptune 11° in Aries.
" 28. Moon highest.
" 29. Mercury in Perihelion.
" 29. Moon Apogee; tide lowest.
" 31. Uranus 10° in Leo.

JUPITER'S SATELLITES.

The following are the most interesting phenomena which may be observed in the *evenings* of August:

	D.	H.	M.					
Aug.	6	11	44	eve.,	Sat.	II,	Oc.	Re.
"	7	11	44	"	"	I,	Ec.	Dis.
"	9	11	51	"	"	III,	Tr.	Eg.
"	16	11	27	"	"	I,	Oc.	Re.
"	20	11	47	"	"	II,	Ec.	Dis.
"	22	10	44	"	"	II,	Tr.	Eg.
"	23	10	1	"	"	I,	Ec.	Dis.
"	24	10	33	"	"	I,	Tr.	Eg.
"	29	10	29	"	"	II,	Tr.	In.
"	31	10	7	"	"	I,	Tr.	In.

EXPLANATION:—Oc., occultation; Ec., eclipse; Dis., disappearance or beginning; Tr., transit; In., ingress or beginning; Eg., egress or ending.

THE MOON, IV.

The Alps (80); a lofty and very steep chain rising into separate peaks; one of the highest is Mount Blanc (next to which the number on the map stands)—rises more than 13,000 feet. It is always easily found. Cassini (81) is a very curious ring-plain, having narrow walls and casting a long spire of shade in the First Quarter. It contains a small, deep crater. Aristillus (83) is one of the most conspicuous objects to be seen in the moon, and always attracts the eye first. It is a crater 34 miles broad and 11,000 feet deep, with a fine central mountain. The ring is very steep, and is surrounded by radiating banks, resembling lava streams—best seen about one day after First Quarter. South of it is a companion crater (84), nearly as deep and bearing less evidence of a flow of lava. They seem to be connected by low ridges. The Apennines (85) is a very extensive chain, more nearly resembling the mountains of the earth than is generally the case. Its length is 460 miles, running over into the next quadrant. It casts a shadow 83 miles long. Huygens (90) is

its loftiest peak, rising to a height of 21,000 feet, and bearing on its apex a minute crater. Other peaks, though not so high, are, nevertheless, of extraordinary height and steepness: Hadley (87) is 15,000 feet; Bradley (89) is 13,000 feet; and Wolf (92) is 11,000 feet. The gradual entrance of the summits into sunshine, about the First Quarter, is a glorious spectacle, and their projection beyond the darkness, thrusting their high heads through the blackness below, and receiving the golden rays of the sun, give them the appearance of golden islands in a sea of ink, which may be seen by a keen eye, and which probably first gave rise to the idea that the Moon was mountainous. An idea of the abruptness of this range may be formed from the fact that its shadows do not disappear until a few hours before the full. It contains but very few craters, and consists of ridges and peaks. Upon the southwestern border of the Sea of Vapor (L), and passing through the well-known crater Hyginus (93), is the canal of Hyginus, indicated upon the map. It can be seen with a power of 40 under any moderate-sized objective. It begins at the foot of a long low hill, as a flat valley about 1½ miles wide and 9 miles long, contracting to about one half that width, with steep sides and great depth; passes by four minute craters and ploughs its way through the massive walls of Hyginus, and throwing up walls upon either side upon the inside of the crater. Here it bends and begins to grow shallow. It was just north of Hyginus that Dr. Hermann J. Klein, of Koln, discovered a new crater about ten years ago. The discovery was confirmed by all the leading astronomers of Europe and America. Hence, the Moon is not a "dead world," but still liveth, though undoubtedly very near its end.

Penn Yan, N. Y.

Filing Flat and Other Surfaces.

(Concluded from page 75.)

One of the chief obstructions to filing a flat is that the natural action of the hand and elbow are in circular lines. This occurs, as will be seen from the joints of the limbs in action being the centre of motion. It is to overcome this that the careful training of the hands is required to enable a flat surface to be filed. The amateur or mechanic, whichever it is, must be careful in the selection of his file-handles; they should be in proper proportion, not too large and not too small. Now here is a point upon which scarcely two men agree. Some like a large, bulky handle: others prefer a smaller, but one with less curve in it; so this must be left for the operator to suit his own taste. I have many times seen a man take a piece of chisel-rod that happened to be near him, and simply stick the file into it. This is decidedly wrong; it shows a slovenly workman, to begin with, and is exceedingly dangerous, as a file is likely to slip out of such a temporary thing, and if it should do so, the consequences may be most serious. The best description of handles are those made from the softer kinds of wood, and they should have strong iron or brass ferules round the ends into which the tang of the file is driven. The shank or tang of the file is made in a taper form, and should be well fitted into the handle by means of a router, which is made in a similar shape and cut across like a float, which instrument (the float) is used by cabinet-makers. This need not be hardened, as it is only used to cut soft wood. It is made with a shank to hold in the vice, the handle to be cut out is to be held in the hand; a few thrusts to and fro will cut out the inside to the shape of the tang of the file. This done, the shank is then driven into the handle, but not clean up to the end, as if this occurs, the file will be likely to soon drop out of the handle. From this cause we once had a man whose left foot was pinned to the floor by the file, a heavy one, falling straight down out of its handle. This fact induces me to ask all intending vice-men to pay particular attention to the handling of their files. Many other ways have been resorted to, to open the handle to fit the shank, such as making a piece of iron of a corresponding shape red-hot, and burning out the hole. This is bad, as it chars the inside, renders it less likely to wear than anything, and also causes it to slip up all ways. There are also many slovenish ways and means of making shift * * * * Learn to keep your vice clean, and your files in a row neatly arranged, and when taking into use a new set of files, mark one side and reserve the side so denoted for purposes that require an extra sharp edge. Again, have a set of files for different metals. As I have said, when they will not cut brass well, they may be used for iron and steel, and will be quite as good as new ones; but if used upon cast-iron or steel, they will be of no use whatever for brass. In cast-iron especially the scale is fatal to a good file, therefore, see that the sand and rough parts are well rubbed off with any old worn-out file. There are many different ways of finishing vice-work; some draw-file a long piece, which is done by placing the file across the work at right angles, and with both hands draw it backwards and forwards. Much practice is required to do this effectually, and if not properly done, the marks left from the file, instead of being in a straight line, will be across the corners, and when finishing work it is a troublesome job to

get rid of them. The finishing or polishing of all vice-work is a matter that requires patience. Here, again, many methods are employed, such as emery sticks, emery cloth, emery paper, etc. The best plan I have always found, during some years experience, and the same I now adopt, is to fold round a suitable-sized file a piece of good emery paper. If this is nicely done, the surface will be as flat as that of a file, and the process of polishing will not round off the edges. This is a most important point in finishing good work. When the polished surfaces present a rounded appearance, it creates a great impression that it is either of inferior quality, or else some second-hand work that has been got up several times. The finish of good work goes a long way to establish its superiority. Another point must be well looked to, and that is, be particular not to have a high polish and deep scratches. In some cases the glare produced by high polish becomes to the uninitiated paramount to a finish, but the enlightened and educated mechanic will view this with disdain similar to that shown by a West End jeweller on examining articles composed of Abyssinian gold.

In these few remarks enough has been said respecting the method of holding, filing, and the getting up of a flat surface, so far as they refer to that alone. I allude principally to work that requires such high finish as described. For ordinary work, draw-filing, when well done, is generally considered sufficient, and I must say I duly appreciate *such when it is perfect.* Having gone so far, before proceeding to describe the manner in which other branches of this interesting work are executed—such as curved lines, square and mortice holes, etc.—I think a hint as to cleaning the files will be deemed necessary. A very general practice is to use what is called a file-card. This is similar to a scratch-brush, and is composed of a piece of flat carding nailed to a block of wood, and when used, should be in a transverse direction across the file. But beyond the ordinary metal that will accumulate in the file, thereby clogging, sometimes, or rather very often, it will become full of what are termed "pins;" that is, small pieces will firmly wedge themselves into the teeth, and do much damage to the work, in as much as they cut out deep lines, which will take a deal of time to eradicate. This often occurs from working the file quite dry, especially a smooth one, and it may be avoided by using a little oil or chalk. Either of these additions will make it cut several degrees smoother. However, we will assume that the file has become filled with these so-called " pins," and all the persuasion possible will not induce the card to remove them. The best plan I have always found is to have at hand a small piece of sheet brass or tin, beaten out at one end, and with this they may be easily disposed of, by manipulating it in the same transverse direction as the file card, except that instead of brushing, as it were, you simply push out the pins, without doing any damage to the file. We now come to a different description of work to be executed with the file, and I do not think we can do better than take for our example curved lines, although many such are now done in shaping-machines, which useful articles, by the way, have reduced the maximum of skilled vice-men; at the same time, an efficient workman must be capable of executing any shape that may be required. In the production of the various mouldings, etc., that are likely to be required, a number of different files will be requisite, such as crossing, rat-tail, half-round, pillar, warding, and many others too numerous to be detailed. The great thing to practice is the movement of the wrist; nothing but experience will enable a vice-man to show perfect work of this description. When making a shape, say an ogee-moulding tool, which tool may be required to produce a quantity of work from it all exactly alike, the hollow part must be taken out with a half-round or a crossing file, which will depend upon the curve and the opposite curve with a narrow pillar file. Possibly to a person that has had some experience—and it is scarcely what a novice would undertake—this would not be found a very difficult task; but having make the one to his satisfaction, let him now make the reverse tool to fit it exactly, without showing light through it when held to the daylight. When this can be done, the person who succeeds in so doing will not require any more of my limited brains to tell him how to proceed with a course of instruction in which he must be well versed. As to the various shapes to be produced, I will not attempt to enumerate them, suffice to say that I have made myself, in tools of this kind, some six or seven dozens of different shapes.—*Forge and Lathe.*

One Cause of Bathing Accidents.

The *London Lancet* gives the following very excellent caution to bathers: "It is very generally believed that the proper way to bathe is to take a header into the sea, or, at least, to immerse the whole body immediately. Theoretically this may be done, so far as the most vigorous organisms are concerned, but it must not be forgotten that a man may be perfectly healthy, and yet not endowed with sufficient latent energy to recover quickly from the 'shock' which must in all cases be inflicted on

the nerve-centres, by suddenly plunging the whole surface of the skin, with its terminal nervous twigs, into a cold bath. For a time, at least, the central activity must be reduced in force, if not in form. When, therefore, a man plunges, and immediately after strikes out to swim, it is not only possible, but probable, that he may become exhausted, and fail from depression of energy, with cramp. It is important that this should be noticed. We do not think sufficient attention has yet been given to this cause of 'accident' in bathing. Cases of exhaustion from remaining too long in the water with a full stomach are understood. That to which we have adverted is not recognised."

EXCHANGES.

Wanted, "Butler's Family Aquarium;" will give in exchange two books, entitled "Laughing Gas" and "De Walden's Ball-room Companion." E. R. Brown, Box 25, Covington, Ind.

A small printing press and outfit, cost $12, for steam engine, Demas lathe and scroll saw, or offers. Ernest Corthell, Rockport, Maine.

A patent spectograph, cost when new $1.25; rare minerals, birds' eggs, and postage stamps, to exchange for minerals, foreign coins, Indian relics, or offers. Frank F. Fletcher, St. Johnsbury, Vermont.

Eggs, of the English sparrow, for good specimens of other birds' eggs; botanical specimens mounted and unmounted to exchange; lists exchanged. C. R. Hexamer, New Castle, Westchester Co., N. Y.

Two telegraph instruments, nearly ½ mile of wire, one battery; also 4 in. magnet, 8 Scientific American Supplements, full of information; new history of United States; a $4 German silver-trimmed flute; what offers? Ewing McLean, Greencastle, Ind.

Wanted, The Workshop Companion; I have Gaskell's Compendium, $1; The Round-of-Months, 75c.; Amateur's Hand Book, 15c.; also books, papers, pictures, etc.; send lists of what you have to exchange. W. B. Moore, Morgan Station, Ky.

McAllister's magic lantern and 30 pictures (cost over $95), to exchange for job type and material, or a good microscope and specimens; $20 worth of novels for a good $15 or $20 household microscope; rare mineral and Indian relics for exchange or sale; refers to editor. John T. Patrick, Wadesboro, N. C.

What is offered for one of the Climax extension step ladders? H. E. Phelps, Manhall, Michigan.

Wanted, a good microscope in exchange for a scroll saw; instrument must be in good order, and magnifying power of from 200 to 300, or 400 diameters. H. E. Rhodes, Brighton, Iowa.

To exchange, a $3 microscope for some old issues of Canada postage stamps. Wallace Ross, Lock Box 97, Rutland, Vt.

Wanted, a printing press; have for exchange a good microscope (Smith & Beck, London), 3 object glasses, and three eye pieces, power from 15 to 600 diameters, original cost $60; books, chemicals, guitars, and other things for exchange. E. F. Underwood, 9 Murray St., N. Y.

Wanted to exchange, Colorado minerals, such as jasper, smoky quartz, silicified wood, etc., for good specimen fossils, or perfect crystals of minerals of other localities. H. F. Wegener, Denver, Colorado.

One Natural Philosophy, one Bryant & Stratton's Counting-house Book, and two long bows, with arrows, to exchange for cabinet specimens or curiosities. W. D. Wright, Lock Box 17, Bremen, Indiana.

Wanted, coins, minerals, and type; send lists of what you have and what is wanted in exchange. A. Campbell, Derrick City, McKean Co., Pa.

An Excelsior Printing Press, with equipments, comparatively new, cost over $47, for double barrel breech-loading shot gun, with reloading tools and shells. William A. Hervey, Box 134, Taunton, Mass.

To exchange, 400 stamps, all different, in a stamp album, for a small printing press with type, etc. Arthur D. McGerald, 106 Bird Ave., Buffalo, New York.

Revolver, microscope, microphone, 4 magnets, skates, skate sharpener, copying pad, books, magazines, $7 worth of rosettes, and lots of other things to exchange; I will give you a better trade than anyone else can. Chas. T. Conover, Esperance, Scho. Co., N. Y.

To exchange, $5 pair of telephones for mounted microscopic specimens, good objective, lathe chuck, watch, type and cases, or offers; describe offers. Wm. R. Brooks, Phelps, N. Y.

What offers for Roger Scroll Saw, 55 large patterns. J. Brower, 3,150 Frankford Road, Philadelphia, Pa.

Photographs of ten of the most influential Indians of Spotted Tail Agency, including Spotted Tail and family and four oil chromos, very beautiful, for printing press, scroll saw, or offers. Luther Emerson, Creighton, Knox Co., Neb.

"Appleton's Picturesque America," never been read or handled, value $24; "Dana's Mineralogy," $10, and coins, to exchange for a breech-loading shot gun, Winchester or Evan's rifle, or offers. D. M. Fuller, Box 115, Camden, Maine.

Scroll sawing outfit, $6; microscope, $3; pocket telescope, $1; Gaskel's Compendium, $1; Williams' Complete Painters' Guide, $2. What offers for all or part; printing outfit preferred. F. W. McNair, Box 46, Fennimore, Wis.

$7 worth of books or papers, to exchange for a Household microscope or offers. Jonas D. Rice, 221 Academy St., Mercer Co., N. J.

One pair best steel climbing irons, handsome seven shot, 22 calibre revolver, full nickel plate, ten dollars worth of boys' papers, and magazines, for works on natural sciences or offers. W. M. Stribling, Circleville, Pickaway Co., Ohio.

Idaho cabinet minerals, books, revolver, stencil outfit, an electrizer, for well-bound books of travel, biography, history, science, masonry and others of an instructive nature. J. P. Clough, Junction P. O., Lemhi Co., Idaho.

Dumb bells of all sizes, to exchange for most any thing; send for circular containing weights of them to J. P. Donohue, Box 7, Davenport, Iowa.

Wanted, scientific books and papers, microscope, drawing instruments, telephone, stamps and coins, in exchange for scroll saw, type, cards, revolver, shot gun, magazines, scientific books, or almost anything. W. L. Goodsell, Bath, N. Y.

A pair of New York Club skates, worth $3.50, also coins, minerals and postage stamps, for books or offers; correspondence invited. E. F. Greene, P. O. Box 889, Bath, Steuben Co., N. Y.

A nice marine oil painting, ready framed, worth $5.00; state what is offered in exchange. C. Hammond, Artist, P. O. Box 47, Chatham, Barnstable Co., Mass.

Photographic camera, one portrait and one landscape tube, with chemicals complete, in exchange for medical books. J. Frederick Herbert, 1,324 Poplar St., Philadelphia, Penn.

Trump's and Russel's scroll patterns, worth $10; for large lenses preferred. H. J. Peters, Rogersville, Ohio.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

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How to Learn to Draw.

MANY young people who are anxious to learn the art of drawing in some of its numerous departments cannot procure the assistance of a teacher, and are therefore at a loss to know how to begin. In drawing, as in many other things, it is the first step that is the most difficult, and too often we find young people discouraged and confused because they commence some department for which their natural talents and previous training has not fitted them. It has occurred to us that a few words in regard to the different departments of the subject, and the preliminary studies required, would prove of value to many of our readers.

The art of drawing enables us to represent upon a surface objects which have more or less depth or solidity, and we can thus convey to the mind a correct idea of whatever we wish to represent, whether it be a landscape, a house, a machine or a person. And when the drawing has been accurately made, according to correct rules, it enables us to reproduce exact copies of such subjects as are within the scope of our constructive abilities.

There are several distinct branches of the art, and these several branches require varying degrees of natural talent, and different kinds of preliminary training. The principal divisions are free-hand and instrumental drawing, and each of these has its subordinate but distinct sections. By *free-hand* drawing is meant the production of figures by the hand and pencil alone, without the use of rulers, compasses or other guides, while instrumental drawing allows the use of rulers for straight lines, squares and triangles for setting off angles, and compasses and templates for laying out curves. These two methods, free-hand and instrumental, may be applied either to simple projections or to the most intricate methods. Thus we have *sketching,* in which, by a

free-hand process, the artist gives a representation of any object placed before him and geometrical perspective, in which the lines and distances are measured off and laid down by means of instruments. Some kinds of drawing are named after the special application which is made of them, as map drawing, architectural drawing, machine drawing, etc., and although the principles and rules employed are the same in all, yet skill in any one branch depends very much upon the experience which has been had in it, so that it is not uncommon to find persons who are very skilful in one department, and yet are not very successful in others.

As an extension of the art of drawing, and frequently confounded with it, we have the art of *designing*, in which no actually existing object is figured, the draughtsman relying upon his ideality and imagination for the figures which he produces.

The student will do well to endeavor to acquire clear ideas in regard to the special branch to which he proposes to devote his attention. For practical purposes the different branches of the art may be arranged under three principal heads:

1. *Pure art*, in which, by means of free-hand drawings and sketches, effects are produced which are valuable for their own beauty and interest, but are not necessarily of any use in the industrial arts or in every-day life. Such drawings resemble pictures or engravings—they are kept merely to be looked at, and the degree of skill which is required to produce them of superior excellence, confers upon them a pecuniary value which is sometimes very high. Artists capable of attaining this high degree of excellence are born, not made, and to those who aspire to this department of art, we cannot presume to have anything to say.

2. *Free-hand drawing as applied to the Arts.* This may consist of mere sketching, which gives an idea of the form but not always of the exact size of the different parts of objects. The power to make free-hand sketches is invaluable, as it enables us to note down in a rapid manner things which could never otherwise be committed to paper. It has also a special value in its influence as a means of mental training, since no exercise cultivates the powers and habit of exact observation so thoroughly and so rapidly as the art of drawing. When we see an object we carry away a vague idea of its general form and outlines, and even this we are not *compelled* to do, so that if the mind is in a listless or inattentive mood, we may pass over entirely many of the most important features. When, however, we attempt to make a drawing, we are compelled to attend closely not only to general features, but to details, and the training thus acquired is invaluable. In addition to this is the exercise of transferring to paper the ideas thus acquired. This involves the accurate measurement of distances and the correct estimation of direction and form, as well as of color, shade, etc.

3. *Design.* Those who by native skill and judicious training have acquired a high degree of skill in free-hand drawing, frequently apply themselves to the production of designs to be used in such arts as the manufacture of pottery, silk fabrics, paper hangings, etc., etc. These designs may constitute either modified forms of the objects themselves, such as new vases, goblets, plates, etc., or ornaments to be applied to the articles. Training in this department consists (1) in so moulding the ideas and imagination of the student that he may be able to originate the ideals which are to be embodied, and (2) in acquiring the power of transferring the ideals to paper. In general the power to transfer to paper is acquired before the ability to originate is attained, and indeed the latter is frequently absent where the former exists.

The power to originate designs of true merit can only be acquired by a careful study of the principles of art, and a thorough contemplation of the best pre-existing models. From these, new combinations may be evolved, and if the student pay judicious attention to the infinite variety of wonderful and beautiful forms which are constantly presented by natural objects, new elements, affording the most valuable and original designs,

may be obtained. It very rarely happens that designs of true excellence are evolved by the artist from the "depths of his inner consciousness." Almost all the best designs are combinations of existing forms, and hence the importance of extended and careful study.

Those who desire to acquire skill in the art of free-hand drawing, should devote their attention to it before commencing the study of mechanical drawing. In the latter dependence is placed wholly upon instruments; the eye and the judgment are never consulted in regard to the length of a line or the position of a point, and consequently, in those who depend wholly upon instruments, the power to lay down figures by the hand and eye alone becomes gradually weakened, or at least it ceases to acquire strength. If this weakening should take place before the faculties have been developed by practice and culture, it will be very difficult to restore them, therefore the student who desires to become an expert both in free-hand and instrumental drawing should always study free-hand drawing first. We have known many who became skilful mechanical draughtsmen after they had studied free-hand drawing, but we have never known a case of one who, after a prolonged dependence upon the aid of instruments, ever acquired that boldness of touch which constitutes the perfection of free-hand drawing.

4. *Instrumental Drawing.* In this branch the draughtsman depends entirely upon the aid of mathematical instruments for laying down lines and points with the necessary accuracy. The simpler branches of this kind of drawing demand no great natural ability; care, neatness, and such a knowledge of elementary principles as may be easily acquired by almost anyone, are quite sufficient, and the ability to apply these, forms one of the most valuable acquirements which a young man can possess. Mechanical drawing may be said to be the written language of the constructor, and it is far more clear, expressive, and unmistakable than any mere combination of words. Every man who at any time requires the services of the blacksmith, the machinist, the carpenter, the builder, or even the tinker, will find that the ability to give his ideas shape in the form of a working drawing will save him much time, trouble and expense, while to the young man who is learning a mechanical trade the art of drawing is as necessary as the art of writing.

PRELIMINARY STUDIES.

Drawing, like all other arts, requires for its successful practice a combination of science and art—of science that we may know what to do, and of art that we may have the necessary skill to apply our knowledge. The knowledge required by the student of drawing consists chiefly of a familiarity with straight and curved lines and their relations to each other, and with the phenomena of light and shade, for it is by the proper laying down of lines and putting in of shades and shadows that all the effects of drawing are produced.

Therefore, those who desire to become proficient in drawing of any kind should by all means first take up the study of elementary geometry, and make themselves thoroughly master of at least so much as is covered by the first four books of Euclid. The slight knowledge which is obtained by the study of what is known as *Practical Geometry*, is not enough; the student must not only know how to erect a perpendicular by means of a certain formula, but he must understand the geometrical laws by which the formula gives him the desired result. If he has not this knowledge, he will be continually floundering in the dark, liable to commit mistakes at every step, and making, at best, but slow and uncertain progress. On the other hand, those who have even an elemententery knowledge of geometry, are always sure of their ground; they know that certain lines must have such and such relations to each other as regards parallelism, length, etc., and they are not at a loss to know just what the results of a certain method of construction will be. They waste no time in applying superabundant and useless tests of accuracy, and they do not commit the fatal mistake of relying upon false tests.

We are the more emphatic upon this

point, because it is one upon which even professionals often fail. A striking example is to be found in a recent work on Mechanical Drawing, in which the author is very careful to caution us about having the blades of our T squares at perfect right angles with the stock! Now, to have them nearly at right angles, or square with the stock, is all right, but to spend any labor in securing great accuracy in this respect is, as we shall see further on, a great waste of labor. If the board is square the drawing will be all right, provided the stock and blade of the T square are firmly fixed together.

It is not intended, by what has just been said, to belittle the study of Practical Geometry, as it is called. To do so would be to insist that the student shall solve all the practical problems for himself, and this would be manifestly absurd. Every good text-book of drawing contains the more important problems required, and these should be carefully and frequently worked over until the student is familiar not only with the printed directions, but with the actual manipulations required, for in drawing, as in everything else, finger-skill (handicraft) is quite as important as theoretical knowledge. A sound knowledge of theoretical geometry is of great value to students of free-hand drawing, as well as to those who devote themselves to mechanical drawing, and to all it is invaluable as a means of mental discipline.

The instruments required by students of free-hand drawing are few and simple. A smooth board, some cheap but firm paper, and a few pencils of varying degrees of hardness are all that are absolutely necessary. The beginner must commence by copying simple lessons, never using compasses, straight edges, strings, or other devices for laying down points or measuring lines, for to do this will be to destroy confidence in one's self, to weaken the power of estimating distances and directions, and to induce general laziness and inattention. Above all things, avoid those ingenious devices which are constantly being described in our popular scientific periodicals, such as sketching frames, transparent slates, drawing windows, etc. By means of them you may be able to make a few worthless copies of engravings or drawings, but you will destroy your chances of being a draughtsman.

But while we would urge the student to avoid the use of instruments in *laying down* lines and points, it will be of great advantage to him to test the accuracy of his work from time to time by means of rulers, compasses or strings. In this way he will easily see which way his errors tend, and will get a hint towards correcting them. He will also be encouraged by seeing that practice and attention have enabled him to make perceptible improvement.

Nothing but practice and faithful attention will confer the necessary skill and power. Therefore make copy after copy of the lessons set before you; after a time pass on to sketching from actual objects, whether models or natural objects, and keep practicing at this. For directions as to the actual practice of the art we must refer our readers to the text-books, and those who cannot devote much time and effort to this department will find a series of very simple and useful lessons in some of the previous numbers of the Young Scientist.

For the study of mechanical drawing more elaborate instruments are required, though even at the best they are not very costly or difficult to procure. It is easy to find in the stores where artists' materials are sold, cases of instruments costing two or three hundred dollars, but these are more ornamental than useful. At the same time we must caution our readers against those cheap sets which are offered for sale by almost every stationer. They are made, like the peddler's razors, to sell, not to work with, and it would be utterly impossible to make a good drawing with them. A very fine set, containing, however, no instruments but those which are absolutely indispensable, may be had for five dollars, or even for three and a half.

The first step should be to acquire neatness in the use of the tools, and the most profitable way to attain this is to go carefully over all the problems of practical

geometry several times, laying the lines down with the utmost accuracy and delicacy that is possible. Give special attention to the more difficult and intricate problems; study the different tests for the accuracy of your work and apply them carefully. In addition to this, study the construction of your tools and the special points which enable you to do good work. Learn by practice to handle them with great delicacy. For example, practice until you can mark points on the paper with the legs of your compasses so delicately that the marks, though visible, do not injure the paper, and see how many circles, arcs, etc., you can strike from one centre before that centre disfigures the drawing.

After having acquired a knowledge of the properties of lines, and skill in laying them down, proceed to make copies of any good architectural or machine drawings that you can find. Having laid them all down carefully, in pencil, proceed to ink them in with China ink, and afterwards to color them with the proper colors. Try also to acquire the art of shading and flat tinting by means of lines drawn in ink with the ruling pen. This method of finishing a drawing is very neat, but to beginners it is exceedingly difficult. They cannot get the lines at the proper distances apart. Some lines are too far apart and some too close. The lines also are of unequal strength. This gives an irregular or *clouded* appearance to the drawing, and is very offensive to an experienced eye. Practice alone will enable the student to acquire the necessary skill and avoid these defects, though a good deal will depend upon certain manipulations of tools and ink, for which, unfortunately, directions are not usually given in the books. For the purpose of aiding the self-taught student we shall devote some attention to this in a subsequent article.

What we have said thus far, both as regards free-hand and instrumental drawing, refers, of course, almost wholly to the making of copies, either from other drawings or from the natural objects themselves. This, though a comparatively low step in the art, is an important one, and one that should be thoroughly studied. The higher departments, in which original design comes into play, requires far more thorough training and a wider range of knowledge. To make a drawing of a steam engine as it stands is one thing; to design an engine which shall have new and valuable features is another, and perhaps the latter should not be referred to the department of drawing, but to a separate and distinct branch. That which is very obvious in the case of the steam engine, however, is not so clear when we come to consider mere ornamental matters, and hence we find that most untrained persons who speak of drawing and advocate its introduction into our schools, do so because they believe that the pupils will at once be able to produce new designs which will be of great value in the arts. It is hardly necessary to say that in nine cases out of ten this hope will prove fallacious, and then will come a reaction and a great outcry about the uselessness of all such instruction.

Those who desire to acquire the ability to produce original designs which will have any value, either financially or otherwise, must devote themselves to the subject as to a life-work. The mind must be trained by long culture to appreciate that which is truly beautiful, and with most minds the extent of study required is very considerable. It is only the half-taught student that thinks he has acquired it all. In addition to this training, as regards perception of the beautiful, the student must lay up a large store of forms in their various combinations. The pencil must be kept in constant practice, seizing upon little bits of artistic work and fixing them so that they may be laid aside and afterwards worked into other combinations. Nature must be ransacked for new and beautiful forms, and the air, the earth, and the waters must be compelled to yield their tribute to the artist's portfolio. Even those regions which have hitherto been a sealed book to the multitude must be carefully studied, for Nature seems to have reserved for her lowest forms of life the finest work in this direction. The exquisitely beautiful forms of diatoms, desmids, polycystina, foraminifera, and other microscopic organisms afford a most extensive and hitherto totally unworked field for the designer.

Home-Made Telescopes and Microscopes—VII.

GENERAL REMARKS ON MAKING OBJECT-GLASSES.

THE directions for working glass surfaces to a correct figure, may appear to some too practical and characteristic of the workshop; but it is only by a strict attention and study of such details that perfection can be insured, and without their aid, the deductions of the mathematician must fail in their proof. Though the early training of a mechanical profession has familiarised me with such pursuits, yet I must confess that I am ignorant of the methods adopted by our best makers for working their minute object glasses; and, therefore, if some particulars may have the merit of originality, others are perhaps not in accordance with the most improved practice.

The first attempt to construct an object-glass (¼ in.) is recorded in the year 1850, on the then well-known form shown by Fig. 11. The back lenses had an excess of

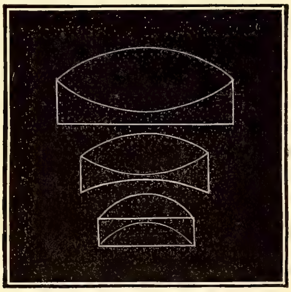


Fig. 11.

negative aberration, or were over-corrected, to enable the adjustment for covering-glass to be performed by the separation of the front lens, which was under-corrected for that purpose. But on attempting to improve the correction by a difference in the radius of the concave flint of the triple front, it was shown that a considerable alteration was here required to effect a material correction for color. Taking a ray at the focal distance from the front surface, and tracing its refraction through the triple, at all points, it appeared to enter the concave surface nearly as a radius from its centre. Consequently, under this condition, the effect of the dense flint was partly neutralised.

It then occurred to me to try a single lens for a front. With this combination no satisfactory result could be obtained with respect to achromatism.

Early in the year 1850, Mr. Lister was occupied with experiments for the purpose of improving the higher powers, and then introduced the *triple back*, which has since so eminently proved to be the grandest step towards their perfection, allowing perfect correction to be obtained with the most extreme apertures.

Having received early information of this improvement, I set to work and again tried the single front in combination with the triple back, and constructed a ⅛th on this system, which is considered excellent to this day. For several years I stood alone in my opinion of its advantages; but as numbers of our best object-glasses of the highest powers are now made with single fronts, I am in a better position for advocating this form, particularly as its success was found to depend upon a relative difference of focal lengths in the two back combinations not hitherto employed by others.

At first the single front with the back triple was not successful. Though color was nearly corrected there was a deficiency of aperture, and the combination was spherically under-corrected. On viewing another object under a thicker covering-glass, the definition was greatly improved. By placing other pieces of thin glass over the object, the front lens had to be drawn still closer to the others. This gave an increase of aperture and more perfect definition. A single front was then made, of the thickness which had been found to give the best result, ascertained from the measurements of the additional pieces of thin glass over the object, and the effect was all that could be desired. On finding that the correction for spherical aberration depended upon the thickness of the front lens, the path became easy.

Fig. 12 represents a ⅛th of 130° of aperture constructed on this system, six times the size of the original. The curves are not given as radii, but as the diameters of the

circles in thousandths of an inch—for I thus note them down for the convenience of making and finding the steel gauges and to prevent divisions into two-thousandths, which would frequently occur in

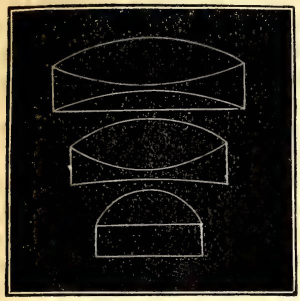


Fig. 12.

the corrections. The following are the curves:—back triple,—posterior of crown, ·312; three next surfaces, crown and concave flint, ·440; front flat, diameter of lens, ·173; density of flint, 3·630; ditto, of crown 2·437.

Curves or templates of middle:—Back, ·233; contact surfaces, ·233; front 1¼ inch, or ⅝ths inch radius; diameter of lens, ·138; density of flint, 3·686; ditto of crown, 2·437.

Single front of crown, ·100 or 1-10th template; diameter of lens ·093; thickness, ·057, measured from the top; density, 2·437.

The focus, or magnifying power, of the two back combinations is very nearly equal, and each 4¾ times that of the single front; for I have found that if the middle is of shorter focus than the back, that it is difficult to obtain satisfactory correction. The lenses are fitted into their cells without shoulders, as their diameter is only just sufficient to admit the full pencil of rays, and their surfaces are utilised to the extreme edge, a desideratum that can always be secured by a proper mode of working.

The aperture of this object-glass is 130°, which is amply sufficient for a good working ⅛th. In the triple back, the three cemented or contact surfaces are of the same radius, as I have not been able to ascertain that any material effect in the correction for spherical errors can be obtained by a difference in the two radii of the concave flint, and, therefore, for the sake of facilitating the workmanship, both faces are similar. I am aware, however, that some makers hold a different opinion and make the incident-surface of the con-concave much deeper, and the other longer in due proportion. The front of the triple is flat; but as the perfection of an object-glass depends in a remarkable degree upon the radius of this surface, a plano-convex lens cannot always be applied as a rule, for the curvature depends very much upon the nature of the glass employed in the construction, and the distance at which the lenses are placed asunder.

The correction for oblique pencils, and flatness of field, are mainly effected by an alteration in this radius, ascertained from the appearances of a globule of mercury, hereafter to be explained. Also, for the convenience of working, the posterior and contact surfaces of the middle lens are of smaller radii, and the required negative correction for color is obtained by an alteration in the concave incident-surface of the flint. The back and middle lenses are worked as thin as possible. It is an easy matter to make convex lenses to a sharp edge; but to insure the requisite thinness in the concaves, the edges are polished before the grinding is completed; and this is continued till they are seen to be as thin in the centre as may be deemed practicable, without the risk of breaking them through.

In the construction of the highest powers of the microscope, or such as are composed of three distinct sets of lenses, it must be borne in mind that the magnifying effect is obtained principally by the front lens; and the combined operation of the middle and posterior, is entirely corrective; and their application in any combination must always be so considered, and not as a means of obtaining additional power. If the front of an eighth or one-twelfth is tested alone, it will be found to magnify nearly as much as when the other lenses are replaced.

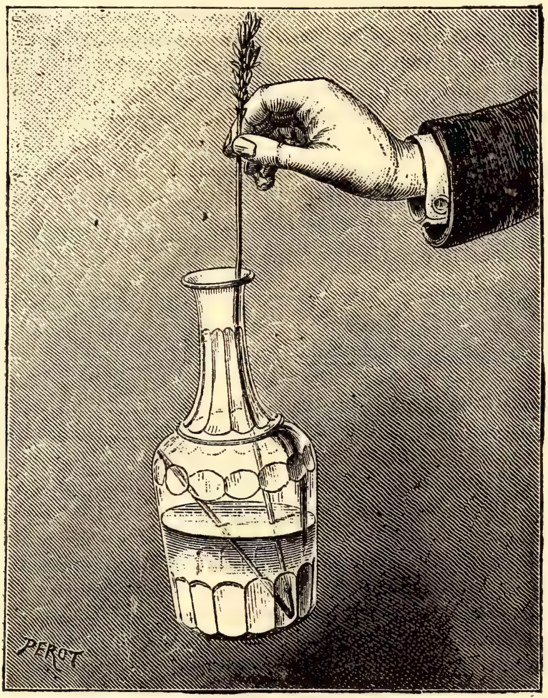
The single front has the advantages of facility of construction, and a command of any required extent of aperture; and

enables object-glasses of higher power to be made than would otherwise be practicable. For example, the radius of the front lens of a 1-50th is 1-120th of an inch, and the diameter is 1-70th. The difficulty, if not impossibility, of constructing a *triple* of such almost invisible atoms of glass may be imagined.

Science in Common-Place Things.

UNDER the somewhat taking title, "Physics Without Apparatus," our French cotemporary, *La Nature*, has published a series of articles which have been extensively copied and quoted. Unfortunately the title is a misleading one, for the author constantly uses *apparatus*, and in some cases he employs apparatus which can be obtained only from dealers in philosophical instruments. And it is still more unfortunate that the explanations and directions are in all cases meagre, and in many erroneous, some of his experiments not being in any sense illustrations of the principles which they are said to render clear. The engravings, however, are very fine as works of art, and we have therefore procured several of them, which we shall present to our readers with original and accurate explanations, and more minute details in regard to the best methods of performing the experiments.

Of the value and importance of experimental illustrations of the laws of science, no teacher of experience has any doubt. One of the great difficulties in the way of such experiments, however, is the expense of the necessary pieces of apparatus, and the difficulty of using them. Several writers have endeavored to suggest means for overcoming this obstacle—the most noteworthy attempt being that of the late Dr. Paris, in his "Philosophy in Sport made Science in Earnest." In a recent article upon this subject, the English journal, *Nature*, thus attempts to impress



LIFTING A DECANTER BY A STRAW.

upon its readers the wide range of experiments which may be performed with very simple means: "It is true that almost all the more important facts and laws of the physical sciences can be illustrated and explained by the help of experiments made without special or expensive apparatus, and requiring only the familiar objects of common life for their performance. The greatest exponents of popular science—and amongst them notably Faraday—delighted in impromptu devices of this kind. It is indeed surprising how, throughout the whole range of natural philosophy, the hand of the master can turn to account the very simplest and rudest of apparatus. A silver spoon, a pair of spectacle lenses, a tumbler of water, and a few sheets of paper suffice to illustrate half the laws of geometrical optics. A few pieces of sealing-wax, some flannel, silk, writing paper, pins, and glass tumblers will carry the clever experimenter a long way into the phenomena of electricity. These are things which any person can procure, and which any person can be taught to use. But their right use depends on the possession of accurate scientific knowledge, and a clear understanding of *what* the various experiments are to prove." To all which we say—Amen!

The first illustration which we take from *La Nature* is an old experiment tolerably familiar to the boys of half a century ago. The author of the article on "Physics Without Apparatus," gives it simply as an illustration of a *lever*, which it certainly is not. The old problem was: "Can you lift a bottle with a straw without tying the straw to the bottle?" The uninitiated were always obliged to give it up, but those who were familiar with the trick carefully selected a sound straw, free from bends or bruises, and then after bending it as shown in the figure, introduced it into the bottle or decanter. Then, on taking hold of the upper end of the straw, the bottle was easily raised. On examination we find that the straw is here pulled at one point and compressed at another. A straw subjected to a pulling strain will lift much more than the weight of a decanter, but if used as a lever it will bend and break with a tithe of that weight. The other part of the straw is in a state of compression. When we pull on the long or upper part it is prevented from coming out because the bend cannot slip up without shortening or compressing the other part of the straw. If the straw is strong enough to resist this the decanter will be held.

It certainly cannot be said that the straw is here used as a "lever." The principle by which we are enabled to lift the decanter is that a sound straw is able to resist a very considerable force when the latter is applied directly, either to extend or to compress it.

It will be found that it is much more important that the straw be perfect between the angle and the lower end, than between the angle and the upper end. Indeed, the slightest bruise or imperfection in this part will allow it to bend, and then it will be drawn out of the decanter. As an illustration of the nature and direction of strains, and the ability of materials to resist them, this experiment is very instructive.

The American Institute.

THE Fair of the American Institute promises to present unusual attractions this year. Amongst other new features, is the admission of the work of amateurs and apprentices free of charge. Amongst the judges in this department are some prominent ladies. So long as the Institute seeks by all legitimate means to foster education and the improvement of the young in industrial and artistic pursuits, just so long will it retain a firm hold upon the hearts of the people and secure that permanent success which can come only to earnest and worthy efforts.

One of Our Pond-Dwellers.

THOSE who take pleasure in examining the living creatures which find a home in our ponds and rivers, must often have come across the beautiful rotifer, of which we give an engraving. It is a conspicuous object, easily seen and examined under ordinary microscopes.

Figure 1 shows the *Noteus quadricornis*

as it is usually seen in the live-box or hollowed slip—swimming about flat. Very often, however, especially when swimming amongst the slender stems of algæ,

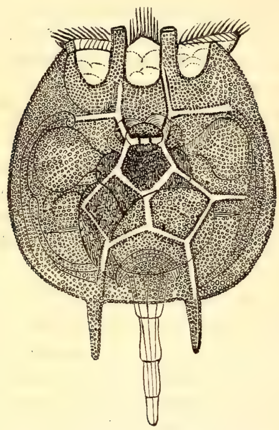


Fig. 1.—NOTEUS, FRONT VIEW.

etc., it turns up on edge and presents the appearance shown in Fig. 2. In this position the young and inexperienced microscopist would hardly recognize it as the same animal. This is, however, a frequent circumstance in regard to microscopic objects. Very many diatoms and

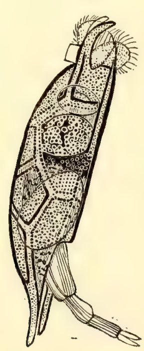


Fig. 2.—NOTEUS, SIDE VIEW.

desmids present such an entirely different appearance when seen in front view and in side view, that unless the microscopist has had considerable experience, or has actually seen the objects rolling over so as to present both views, he will be unable to recognize them.

The Noteus is sufficiently transparent to disclose the working of its internal organs under the microscope. If a little carmine be added to the water the working of the cilia is beautifully seen. The best way to use the carmine is to grind a little of the best water color upon a slab or a very smooth plate, and add a small quantity to the water by means of a camel-hair pencil. The carmine ordinarily sold in powder is too coarse.

Astronomy for Amateurs.

BY BERLIN H. WRIGHT.

(Calculated for the Latitude of New York City.)

THE PLANETS—SEPTEMBER, 1880.

	D.	H.	M.	
Mercury invisible.				
Venus sets	30	6	33	evening
Mars invisible.				
Jupiter rises	10	7	26	"
" in meridian	10	1	49	morning
" rises	25	6	24	evening
" in meridian	25	0	44	morning
Saturn rises	10	7	57	evening
" in meridian	10	2	30	morning
" rises	25	6	55	evening
" in meridian	25	1	27	morning
Uranus invisible.				
Neptune in meridian	20	2	50	"

NEAR APPROACH OF MOON TO PLANETS AND STARS, AND OTHER PHENOMENA, SEPT., 1880.

Sept. 1. Uranus conjunction with Sun.
" 3. Moon near and South of Regulus.
" 5. Venus 7° North of Moon.
" 5. Mars 6° North of Moon.
" 7. Venus ½° North of Mars.
" 7. Moon near and South of Spica Virginis
" 10. Moon a few degrees North of Antares.
" 11. Moon lowest.
" 12. Moon a few degrees North of Milkmaid's Dipper.
" 13. Moon Perigee ; tide highest.
" 17. Mercury superior conj. with Sun.
" 20. Jupiter 7° South of Moon.
" 21. Saturn 7¾° South of Moon.
" 21. Neptune 6° South of Moon.
" 22. Sun enters sign *Libra* (constellation Virgo) and Autumn begins.
" 24. Moon highest.
" 25. Jupiter in Perihelion.
" 25. Moon Apogee; tide lowest.

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS FOR SEPTEMBER 20, 1880.

	H.	M.
Alpha Andromeda (Alpheratz) in meridian	0	4 morn

Omicron Ceti (Mira) variable in Meridian	2	15	morn
Beta Persei (Algol) variable in Meridian,	3	2	"
Eta Tauri (Alcyone or Light of Pleiades) in Meridian	3	40	"
Alpha Tauri (Aldebaran) rises	9	29	even
Alpha Aurigae (Capella) "	6	57	"
Beta Orionis (Rigel) rises	11	36	"
Alpha Orionis (Betelguese) rises	11	21	"
Alpha Canis Majoris (Sirius or Dog Star) rises	1	41	morn
Alpha Canis Minoris (Procyon) rises	1	16	"
Alpha Leonis (Regulus) "	3	19	"
Alpha Virginis (Spica) invisible.			
Alpha Bootis (Arcturus) sets	9	21	even
Alpha Scorpionis (Antares) sets	8	41	"
Alpha Lyrae (Vega) in merid.	6	32	"
Alpha Aquillae (Altair) in merid.	7	44	"
Alpha Cygni (Deneb) in merid.	8	36	"
Alpha Pisces Australis (Fomalhaut) in meridian	10	49	"

MOONS OF JUPITER.

The following are the more interesting phenomena which transpire at seasonable hours during the month of September, and are visible with any ordinary telescope or opera glass:

		D.	*H.*	*M.*			
Sat.	I,	1	9	28	eve.,	Oc.	Re.
"	III,	3	9	51	"	Oc.	Dis.
"	III,	3	11	57	"	Oc.	Re.
"	II,	7	10	19	"	Oc.	Re.
"	I,	7	11	52	"	Tr.	In.
"	I,	8	11	12	"	Oc.	Re.
"	I,	9	8	30	"	Tr.	Eg.
"	III,	10	10	23	"	Ec.	Dis.
"	II,	14	8	50	"	Ec.	Dis.
"	I,	16	8	3	"	Tr.	In.
"	I,	16	10	15	"	Tr.	Eg.
"	III,	21	8	33	"	Tr.	Eg.
"	I,	24	9	9	"	Oc.	Re.

EXPLANATION:—Oc., occultation, or passing *behind* the planet; Tr., transit, or passing *before* or across the face of the planet; Ec., eclipse, or passing into the planet's shadow. During this month the disappearances spoken of will all occur at the left or east of the planet as the shadow is thrown eastward. Dis., disappearance or beginning; Eg., egress or ending. It will be interesting to watch the disappearance and following reappearance of Sats. I and III. The former, passing across the face of Jupiter, may be seen in transit as a black round spot, while the latter disappears entirely behind the planet, to reappear two hours later at the left.

THE MOON, V.

A little west of the western termination of the Canal of Hyginus begins the Canal of Ariadæus; it is larger, broader and probably deeper than the former, having been traced westward over 175 miles, or to the shore of the Sea of Tranquility. Both of these canals may be best seen about the First Quarter. Manilus (95) is a cavity 25 miles in diameter and 7,700 feet deep; its ring is broad, and capped with craters and high peaks. 99 and 101 are brilliant crater rings, and 96 and 98 are very dark hollows. Rhæticus (104) is an irregular crater exactly on the Moon's equator. These complete all of the most conspicuous and interesting objects in the First or Northwest Quadrant.

SECOND OR N. E. QUADRANT.

Near the crater Schrœter (106) have been seen what were supposed by some to be a work of art. The spot is indicated on the map by the fine lines below 106. The discoverer described them as a collection of dark gigantic walls, visible only when close to the terminator (the boundary between the light and dark portions) and extending 23 miles in each direction, being arranged on each side of a principal wall from which they slope off S. E. and S. W. respectively at an angle of 45°. N. is a bay where no craters are to be seen, with ordinary instruments, while upon its N. E. shore lie three grand craters, Eratosthenes (110), Stadius (111), and Copernicus (112). The first two are connected by a steep mountain range 4,500 feet high. The former is 37 miles in diameter, and has a central hill, while the latter is 42 miles in diameter and is level. The ring of the first rises 16,000 feet above the inner surface, and the latter only 130 feet, scarcely visible. East of 111 lies one of the grandest of lunar craters, Copernicus (112), 56 miles in diameter. It has a central mountain that boasts of six heads, two of which are very conspicuous, a noble ring, made of terraces and distinct heights, separated by ravines. The nearly circular summit of the ring rises 11,000 feet from the bottom (the height of Ætna). This crater forms a brilliant spectacle at the time of Full Moon, likened by some to a string of 50 pearls. It is surrounded by radiating walls—lava streams. It is beautifully figured in "Outlines of Astronomy," by Sir John F. W. Herschel, Pl. V, Fig. 2. So said to be by Rev. T. W. Webb, in his "Celestial Objects," though the figure given in "Chamber's Astronomy," (after Nasmyth), Pl. III, Fig. 29, bears no resemblance to it whatever. The figure in Herschel answers more nearly its appearance when viewed with an aperture of 3 or 4 inches, and a day or two after First Quarter.

Penn Yan, N. Y.

Drilling Glass.

One of our exchanges gives the following directions for making holes in glass:—

Stick a piece of stiff clay or putty on the part where you wish to make the hole. Make a hole in the putty the size you want the hole in the glass, reaching to the glass, of course. Into this hole pour a little molten lead, when, unless it is very thick glass, the piece will immediately drop out.

We would advise our readers not to try this on any article that they value. In nine cases out of ten instead of making a clean hole, the molten lead will break the glass all to pieces. A clean round hole may sometimes be made in a plate of glass by shooting a bullet through it. In most cases however the bullet shatters the glass.

To Take Bruises out of Furniture.

Wet the part with warm water; double a piece of brown paper five or six times, soak it in warm water, and lay it on the place; apply on that a warm, but not hot, flat-iron, till the moisture is evaporated. If the bruise be not gone, repeat the process. After two or three applications, the dent or bruise will be raised to the surface. If the bruise be small, merely soak it with warm water, and hold a red-hot iron near the surface, keeping the surface continually wet—the bruise will soon disappear.

The Egyptian Cubit.

In noticing the labors of the International Bureau of Weights and Measures, Abbe Moigno regrets the choice, as the unit of measure, of the ten-millionth of a meridional quadrant, "a unit fatally indeterminate," since the meridians vary in length. He suggests, as a better standard, the cubit of the Great Pyramid, which represents the ten-millionth of the earth's polar axis. Sir John Herschel made the same proposal, nearly thirty years ago, and it is somewhat remarkable that his views should be now advocated by *Les Mondes*, the leading French scientific journal.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business letters or cards they cannot be used.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

Wanted, "Butler's Family Aquarium;" will give in exchange two books, entitled "Laughing Gas" and "De Walden's Ball-room Companion." E. R. Brown, Box 25, Covington, Ind.

Wanted, a good microscope in exchange for a scroll saw; instrument must be in good order, and magnifying power of from 200 to 300, or 400 diameters. H. E. Rhodes, Brighton, Iowa.

A patent spectograph, cost when new $1.25; rare minerals, birds' eggs, and postage stamps, to exchange for minerals, foreign coins, Indian relics, or offers. Frank F. Fletcher, St. Johnsbury, Vermont.

Eggs, of the English sparrow, for good specimens of other birds' eggs; botanical specimens mounted and unmounted to exchange; lists exchanged. C. R. Hexamer, New Castle, Westchester Co., N. Y.

What is offered for one of the Climax extension step ladders? H. E. Phelps, Manhall, Michigan.

To exchange, a $3 microscope for some old issues of Canada postage stamps. Wallace Ross, Lock Box 97, Rutland, Vt.

Wanted to exchange, Colorado minerals, such as jasper, smoky quartz, silicified wood, etc., for good specimen fossils, or perfect crystals of minerals of other localities. H. F. Wegener. Denver, Colorado.

One Natural Philosophy, one Bryant & Stratton's Counting-house Book, and two long bows, with arrows, to exchange for cabinet specimens or curiosities. W. D. Wright, Lock Box 17, Bremen, Indiana.

Wanted, coins, minerals, and type; send lists of what you have and what is wanted in exchange. A. Campbell, Derrick City, McKean Co., Pa.

An Excelsior Printing Press, with equipments, comparatively new, cost over $47, for double barrel breech-loading shot gun, with reloading tools and shells. William A. Hervey, Box 134, Taunton, Mass.

To exchange, 400 stamps, all different, in a stamp album, for a small printing press with type, etc. Arthur D. McGerald, 106 Bird Ave., Buffalo, New York.

To exchange, $5 pair of telephones for mounted microscopic specimens, good objective, lathe chuck, watch, type and cases, or offers; describe offers. Wm. R. Brooks, Phelps, N. Y.

What offers for Roger Scroll Saw, 55 large patterns. J. Brower, 3,150 Frankford Road, Philadelphia, Pa.

Scroll sawing outfit, $6; microscope, $3; pocket telescope, $1; Gaskel's Compendium, $1; Williams' Complete Painters' Guide, $2. What offers for all or part; printing outfit preferred. F. W. McNair, Box 46, Fennimore, Wis.

$7 worth of books or papers, to exchange for a Household microscope or offers. Jonas D. Rice, 221 Academy St., Mercer Co., N. J.

Idaho cabinet minerals, books, revolver, stencil outfit, an electrizer, for well-bound books of travel, biography, history, science, masonry and others of an instructive nature. J. P. Clough, Junction P. O., Lemhi Co., Idaho,

Dumb bells of all sizes, to exchange for most any thing; send for circular containing weights of them to J. P. Donohue, Box 7, Davenport, Iowa.

Wanted, scientific books and papers, microscope, drawing instruments, telephone, stamps and coins, in exchange for scroll saw, type, cards, revolver, shot gun, magazines, scientific books, or almost anything. W. L. Goodsell, Bath, N. Y.

A pair of New York Club skates, worth $3.50, also coins, minerals and postage stamps, for books or offers; correspondence invited. E. F. Greene, P. O. Box 889, Bath, Steuben Co., N. Y.

A nice marine oil painting, ready framed, worth $5.00; state what is offered in exchange. C. Hammond, Artist, P. O. Box 47, Chatham, Barnstable Co., Mass.

Photographic camera, one portrait and one landscape tube, with chemicals complete, in exchange for medical books. J. Frederick Herbert, 1,324 Poplar St., Philadelphia, Penn.

Trump's and Russel's scroll patterns, worth $10; for large lenses preferred. H. J. Peters, Rogersville, Ohio.

THE Young Scientist

SCIENCE IS KNOWLEDGE. — INDUSTRIAL PUBLICATI — KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

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A Breakfast for a Whale—What it Was, and How it was Got.

BY A. W. ROBERTS.

MANY people who try to keep an aquarium fail in their efforts, because they think that fish can find in the water all the food that they require. The extraordinary quantities which some marine animals require was very fully impressed upon my mind upon one occasion, when I had to provide a breakfast for a whale; and although, strictly speaking, a whale is not a fish, yet the lesson is the same, and I will therefore relate my experience.

One hot sultry afternoon, when trying to copy one of Birket Foster's beautiful landscapes (for when not collecting I was trying to learn to draw), I had become tired of myself. I had tried and tried to acquire the beauty and "touch" of his penciling, but had utterly failed. So, out of sorts, and out of humor with myself and things in general, I started for my favorite pond and woods (I had got to calling the woods and streams my big medicine, for in them I lost all my troubles). In this particular pond grew many varieties of plants; the water teemed with animal life; many birds had built their nests in the shrubbery that grew on its margin, and a full orchestra of tree toads and various kinds of frogs were in attendance as nature's musicians.

When I reached this pond I proceeded to spread out the many newspapers that I had brought with me to wrap the plants in. In one of them my attention was attracted by an announcement in large type of a wonderful young man from the East, who had been secured to take charge of the aquaria at Barnum's Museum (the old museum), whose knowledge of fish was something astonishing, so much so that he knew their language, etc., etc., etc. When I began reading this article I was standing up; when I got half way through

I sat down; and when I got to the end I was rolling on the grass with laughter. Getting myself together, I determined to know all about that young man before I slept. If he knew more than I did he was just the person I was in search of. So, determining to cultivate him, I made a collection, consisting of every variety of fresh-water plant within five miles of the pond—being very careful not to take a plant of which I did not know the class, order, species, and common name. In three hours I had a beautiful collection, carefully assorted, bunched, and washed.

Remaining in the woods till nightfall—for I had become a deplorable looking object, spattered over with mud, broken boots, torn clothing, and scratched face and hands—I preferred darkness to daylight when going through Brooklyn. Reaching the Museum, I paid my way in. Leaving the bundle of plants with the doorkeeper, I started in search of the Eastern fish linguist.

There he was, pacing up and down, his hall deserted on account of the "great moral drama" going on in the "Lecture Room." Getting right in behind him, I ventured to remark, "Mister, there's a big rock on top of one of your eels," (it was only a conger eel that was having a good time under a stone), but he neither paused nor made me any reply, but paced right ahead. He evidently "knew eels," and I thought to myself I must bait again; this time I'll try him with some Latin, for I hadn't forgotten my first lesson in scientific botany, taught me at the John Street seed store. Right ahead of him was a tank containing a large mass of stonewort. Closing in on him again, I exclaimed, "My gracious, what a beautiful specimen of *Callitriche pedunculata.*" He turned short on me and asked what did I say? I replied, in a careless off-hand way, "Oh, I was merely admiring the robust growth of the *Callitriche pedunculata.*" "Oh, y-e-s," he replied, at the same time cautiously and critically examining me from head to foot, then up again. I knew I had hooked him this time. I could see he was bothered, and was trying to place me, but my broken boots, muddy and torn clothing, totally disguised me.

"Are you interested in aquaria?" he asked.

"A little," I replied.

"Are you acquainted with fresh-water fishes?"

"A few," I replied.

Then, leading me to a tank, he asked me if I knew the name of a small fish that was swimming about in the water.

I replied that its name was *Pomotis chetadon*, and that it was one of the handsomest varieties of all the sun fish.

Every minute he grew more pleasant, and I began to come out of my muddy disguise a little, for I had come to the conclusion that I could match him on fresh-water aquaria; still I was anxious to learn. He now became very courteous and affable; for this I felt thankful, as I had often desired to stock some of the large tanks free of charge, that I might study more closely the habits of fish and plants; and I felt that now was my opportunity.

Presently, he asked if I could obtain some plants for him, if he gave me a list of those he wanted, and what would I charge?

In going over the list, I crossed out all that were not in the bundle down stairs, which left me some seven varieties that were not down on his list, and I suspected he had never heard of them or seen them. Then, asking to be excused for a few minutes, I passed down stairs, returning again with the bundle, (Oh, it was a big one). Hardly taking time to cut the yards of string with which it was tied, I began displaying the plants on the floor, at the same time calling off their class, order, genus, species and common name. Fifteen varieties in all, not to mention many kinds of aquatic insects, larvæ, and small molluscs, that went scrambling over the floor.

Well, if you could have seen that young man from the East; for a minute or two he hadn't a word to say. My last move had been executed so quickly and unexpectedly, that I had taken him completely unawares.

His admiration was so honest and outspoken, that I felt already repaid for my

trouble, and that we should become the best of friends in the future.

He pressed me hard to take money, but I refused it, telling him that I felt already paid in anticipating the enjoyment I should derive from seeing the plants in the tanks. Then came the offer of complimentary tickets; these I also declined, as they were of no use to me, (my opinion of Barnum's was not of the highest.) Wasn't there anything he could do for me? I replied that at present not a thing, but, perhaps, in the future, I'd give him a chance to pay me off. He asked me for my address, and when I gave it to him, the same odd puzzled look came over his face, as he again took a look at my wardrobe, and I said to myself, "He's wondering if I live on the fifth floor of a tenement, or in a brown stone front." When I reached home, and went over my adventure to my mother, we had a hearty laugh over it.

Next day, when, arraying myself in broadcloth, new hat and "party" boots, vest and kids, a telegram came, requesting me to come to the Museum immediately. This message puzzled me greatly, but at last I concluded that "Ali," the keeper of the hippopotamus, had stolen all my plants and fed them to "Hippo," and that either by money or coaxing, a new lot was to be obtained. Over I hurried, and when I reached the Museum, great was the astonishment my Eastern friend showed over my changed appearence, but greater was mine when he suddenly asked, with the greatest concern: "Did I know anything about whales?"

"Wait one moment," I replied, "till I sit down and get my breath, for I've run nearly all the way;" and I said to myself, "I must contemplate this thing."

Presently, he repeated the question, "Did I know anything about whales?" and showing more anxiety than before.

"Oh yes," I replied, just as though I was a second Jonah.

"That's all right," said he, "come with me; there ain't a moment to be lost, and I'll show you the 'old man.'" Said I to myself, "Be on your guard; the Wild Man from Borneo has lost his only son, and they are going to snake you into the old man's cage to be adopted." I didn't follow my new friend too closely, and felt that I'd feel much better if I was once more on Broadway. Presently, we arrived at a door that fitted into a tall box-like compartment, which reached to the ceiling, with one small window near the top. Taking out a key he whisked in, the door closing after him with a snap. The stairs from the entrance led up near this room, and I was about to take them, when my friend suddenly opened the door and smiling all over said, "Come in, come in, and I'll introduce you." In I went, and there sat a rather oldish looking man, with a bald head, busy writing. As soon as he paused, my friend remarked: "Mr. Barnum, this is the person I've been speaking about." I was so mixed up that I forgot to say, "How are you, sir," but stood half upright without saying a word. "Well," he remarked, "so you are posted on whales?" I scarcely knew what reply I made, but suppose I said, "Yes, sir." Then he informed me that I must have at least 200 pounds of live fish in the whale tank by ten o'clock next morning. I was going to reply that I couldn't do it, when my Eastern friend winked and nodded to me to say yes, so I replied, "All right, sir." I began to take in the situation. It was evident that I was engaged to obtain a breakfast for a whale that was on the way. I was sorely perplexed, but didn't show it, and was too proud to ask any questions. I had never collected any salt water fish, didn't know where to obtain them, or what kind were fitting for a hungry whale, the size of the whale, nor how large the fish ought to be.

Before starting I was furnished with $50 to pay expenses, and a large amount of passes. How I went to work, and what my success was, I will tell in my next.

— An eccentric individual thinks the government should at once put a stop to boring and pumping for oil. He fears that the oil is drawn from the bearing of the earth's axis, and that the earth will cease to revolve when the lubrication ceases.

Three Amateur Workers—and What They Did.

BY FRED. T. HODGSON.

PERHAPS you know Mr. Carpenter? Well, if you do not, let me introduce him to you. Here he is. You see at a glance, that he is a kind man: fond of his three children—Fred, Jessie and Ellwood—who are in return, very much attached to him. He is a good father; they are good children, and all are equally fond of Mamma Carpenter, who thoroughly believes there are no children in the world so good and so clever as hers; or a man so kind and wise as Papa Carpenter. No doubt, you have met Mr. Carpenter before, in some place that you cannot now call to mind; or, maybe you are acquainted with the boys—Fred and Ellwood—and it may be that you have seen Jessie, or that your sister knows her well. At any rate I wish you all to get acquainted with each other, for if all goes well, you will be in each other's company quite frequently during the coming months, and with your permission I will make the necessary formal introductions:

Mr. Carpenter, permit me to introduce the Reader. Reader, permit me to introduce Master Fred Carpenter. Miss Jessie Carpenter, allow me to introduce the Reader. Reader, Master Ellwood Carpenter. Mrs. Carpenter, who is now busy superintending the preparations for tea, will, at a later period, permit you to be introduced to her, and I am sure you will never regret it. You no doubt see that Fred is about thirteen years old, which he will be on his next birthday; and Jessie, the sunbeam of the house, will be eleven on the fourth of January next; and Ellwood, the harum-scarum boy, the plague of his sister, the pride of his father, and the joy of his mother, has just turned nine, and is as mischievous as boys generally are at about that age; but Jessie thinks he is "just awful," which I suppose must mean something very dreadful, if one may judge by the way she expresses it. Fred used to be mischievous, but this last year or so, since he "passed" for the higher school, he has been more staid, and has applied himself closer to his studies, much more so than he used to do; and Jessie, who, by the way, is a good judge, says he is the best boy in the country, and Ma and Pa, yes, and Ellwood, too, believe her.

Fred likes to work with tools; to be "making things," fixing up the fence, repairing the gates, and mending anything about the house that may be broken. Nothing pleases him better, after he arrives home from school, than for his Ma to ask him to repair some piece of kitchen furniture, or for Jessie to entreat him to put an arm, leg, or head on her doll, or to fix her doll's cradle, chair, or carriage. Last Fourth of July, Ellwood wanted him to make a wagon; a boy's wagon, you know; one with solid wheels, with holes through their centres for axletrees of hard wood to go through. Fred went to work and made one, but such a wagon! You never saw its like before. Of course it had wheels, but such wheels! They were made out of one inch rough boards, and were about eight inches in diameter; they tried to be round, but couldn't. When put on the axletrees and moved around, they wobbled and staggered worse than a paper boat would in a mill-race. An empty cracker box did service on the two axles for a box, and for a time Ellwood was delighted with it. The first person allowed to ride in it was Jessie, and she was nearly as proud of the vehicle as Ellwood himself; for every one she met that day she had to tell them that Fred had just made Ellwood a "real nice wagon," and that she had had the first ride in it.

All the tools Fred had to make the wagon with were an old rusty saw that he found in his father's stable, his father's big jack-knife, a gimlet, a hammer, and a piece of three-quarter inch round iron about two feet long. He used the saw to cut out the wheels and axles, of which the former was quite a job to do; he managed it, however, by cutting the wheels into many-sided polygons, and then whittling the corners off afterwards with the jack-knife. The gimlet was used for boring holes through the bottom of the cracker box, so as to fasten it on the two axles which it held together; it was also used for boring five or six holes through each of the wheels in their centres, after which

the round bar of iron mentioned above was made red hot in the kitchen fire, and while in that state driven through the centre of each wheel, thus making a hole large enough for the hard-wood axles, which, by the way, were whittled out with the jack-knife and saw. These tools were so rude, and so utterly unfit to do anything with in making the wagon, that Mr. Carpenter, who had been watching Fred work, promised to buy his boys some tools in the Fall, and have a little workshop fixed up for them in the barn, which is not far from the house. He also said he would explain what each tool was for, and show them how they were to be used. Of course the boys were pleased—what boys wouldn't be?—for they knew that whatever their father promised them he would surely do; and on this very evening, a few moments before you were introduced into the family, Mr. Carpenter had said to Fred that he thought he would go to the hardware store on the next day and purchase a few of the tools he had promised him and Ellwood, as the evenings were beginning to lengthen out. "To-morrow," he said, "I will have a place prepared in the barn, and will procure some lumber and the tools I spoke of, and if I am not otherwise engaged, I will instruct and assist you in making a small work-bench, and after that is finished I will show you how to make boy's wagons, hand-sleighs, flower stands, stools, and many other things that will be amusing, instructive, or useful." "Oh yes, Papa!" said Jessie, "and won't you show Fred how to make girl's workboxes, doll's cradles, and things?" "Certainly, my dear," said Mr. Carpenter, "I'll show him how to make a whole set of furniture for your doll, and how to build a nice little play-house to put the furniture and doll into; but you must not be impatient, my dear, for you know Fred will not neglect his studies for the purpose of 'making things,' as you express it, and he must also have time to play with the boy's outside, for I cannot allow him to be kept at work all the time, either at his studies or in the workshop I am going to prepare for him." "Oh, I'll wait, Papa, until he gets all the other things made, and then, if Mamma doesn't want him to make or mend something for her, I'll ask him to work at some of the nice things you say you will show him how to make for me."

"I want another wagon," said Ellwood, "for the one with the cracker box on top, that Fred made me last Fourth, is all broken. One of the wheels is split in two, and the axle on the back end is broken, and I can't pull Jessie around with it on three wheels, so I want Fred to make me a wagon first. Can't he, Pa?" "Well, Ellwood, you know," said Mr. Carpenter, "you must wait. Fred will have to learn a good many things before he will be able to make even a fair-looking wagon or cart. And besides, you must not tax Fred too much, he may want to make something for himself before he begins work on your wagon, and in that case you will have to wait." "But I can make a wagon myself, Pa, if you will only let me have the tools," said Ellwood. "I doubt it very much, my son; I'm afraid it would not be so good a one as Fred made you last summer, and which you now seem to despise. However, Fred will, no doubt, make you one as soon as possible, after he has learned to use the tools I shall buy to-morrow."

All this conversation had taken place but a short time before the "Reader" had been introduced; in fact, the introduction, which was somewhat abrupt, interrupted it, and as tea was announced shortly afterwards, it was not resumed again that evening. In the morning, however, at breakfast table, after Fred, Jessie, and Ellwood had gone up-stairs to prepare for school, Mr. Carpenter told Mrs. Carpenter of the promises he had made to the children. She was quite pleased to hear that he was going to purchase tools, lumber, and other necessary materials, but she expressed a fear that some one of her darlings might get cut or injured if they were allowed to handle edge tools, when their father was not present to guide their actions. Mr. Carpenter soon set her fears at rest on this point, by saying that he would see that Ellwood did not get any very dangerous tools to use, and that so far as Fred was concerned, she need have no fears, for he is such a careful boy, and will handle

the tools in such a manner that no serious accident will happen. Mrs. Carpenter also suggested that, as the boys were going to be taught by their father to make useful things, it would not be out of place if she undertook to give Jessie a few lessons now and again, in making such things as will be necessary to dress her doll in good shape, and decorate and properly finish the interior of her play-house, which Fred will no doubt build for her. Mr. Carpenter thought the idea a good one, and it was decided at once that the boys should have a workshop and tools, and should be taught how to use the latter, and that Jessie should learn housekeeping on a small scale—in a play-house—and many other things that a good little girl ought to know.

Reader, you and I will watch these three young people while at work. We may be able to learn something from them or their instructors.

Let us see!

(To be continued.)

Home-made Telescopes and Microscopes.—IX.

GENERAL REMARKS ON MAKING OBJECT-GLASSES.

In May, 1856, I made the first 1-25th with a single front lens of 1-30th in diameter; I am doubtful whether a triple front could be made even of this size, with any positive certainty of accurate workmanship.

From the $\frac{1}{8}$ and upwards, perfect correction may be secured with a single front. It is, however, barely possible to make a good 1-5th with this form, and in a $\frac{1}{4}$-inch it fails altogether; there is a kind of secondary spectrum that cannot be got rid of. It is not easy to define all the reasons why it should succeed perfectly with the highest powers, and the correction be imperfect with the lower ones named. With smaller apertures the errors of spherical aberration cannot be so well corrected by giving thickness to the front lens; and as there is considerable distance between this and the middle, the colored rays from the uncorrected front are so far separated that any corrective action of the back systems is incapable of recombining them. When an object-glass is spherically under-corrected, the focus of the central rays is longer than that of the marginal ones, as in a simple lens. If all the rays are brought to one point, the interposition of a plate of parallel glass projects the outside rays to a greater distance than the central ones, and produces a similar effect to a concave lens, or that of over-correction; and it is for this reason that a certain thickness of glass before, or in the substance of the front lens has such a remarkable corrective power, which is most appreciable with a very large aperture. Where this is comparatively small, as in a $\frac{1}{4}$-inch, the influence of a thick front does not appear to be sufficient to enable the final correction to be obtained by this means alone. The anterior lens must, therefore, either be partly achromatised, or made of a glass of higher refractive and less dispersive power than any at present known.

It is well known that, in a doublet consisting of two single plano-convex lenses, both the spherical and chromatic aberrations are considerably less than in a single

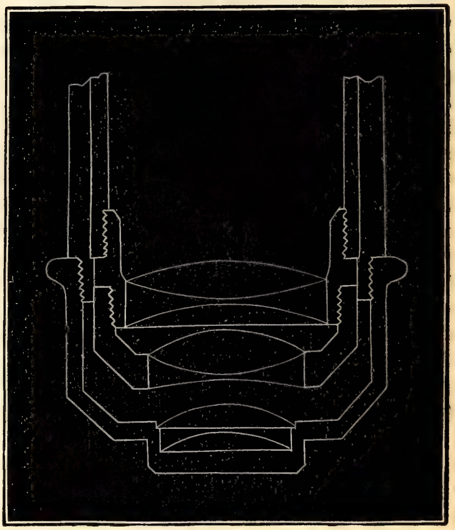

Fig. 13.

lens of the same magnifying power. I have for this reason proposed to construct the higher powers with two single lenses

in front, of equal radius, as shown by the cut. The correcting thickness should be thrown in the front lens. If they are set in contact, the magnifying powers will be nearly as their sum; they may therefore be made of double the radius, and consequently nearly twice the diameter, which, of course, would lessen the practical difficulty of working a 1-50th, and enable us to go even beyond this power. A partial experiment with a ¼th, having this "doublet" front, has proved that perfect correction for color is the result. But in the form tried, the spherical aberration was so considerable, as to require an entire reconstruction, for which I have had no leisure; and though the entire success of the idea is yet unproved, I venture to record it, in case I may never be able to take up this subject again, as I am of opinion that a very perfect object-glass may be made of this form.

IMMERSION OBJECT-GLASSES.

These combinations are under-corrected, and not suitable for use in any other way. The plan is an old one, and objectives were constructed on this principle by Amici and Ross many years ago. That such lenses give brighter and clearer definition, with the highest powers, from the 1-12th upwards, is unquestionable.

BRASS CELLS FOR OBJECT-GLASSES.

For the brass setting of object-glasses, it is necessary that the worker should possess a good foot-lathe; if provided with a self-acting arrangement for chasing up the short screwed parts of the cells, this will insure greater accuracy of workmanship. The setting or metal work of an object-glass must always be made before the lenses are commenced; three steel gauges are to be first formed, of a width exactly corresponding to the diameter of the intended lenses; this gauge I make out of a piece of sheet steel, with three arms of the three diameters required. A chuck should be fitted to the lathe, and cut out to the standard thread now generally adopted for object-glasses; into this the brass setting is fitted, and each cell screwed on, and turned out in succession to the proper size. I leave no shoulders at the back of the cells, but bore them clear through.

Triblet tubing is not sufficiently accurate for the outer shell of the highest powers; it is better, therefore, to make this of one casting, and bore it out of the solid, from its own chuck, and finish to the size with a fluted rimer. I have always made the inner tube, containing the back lenses, to traverse to and fro, in preference to the front lens, as the object is not thereby lost sight of during the adjustment, which is performed in one-third of a revolution of the outer ring, which has an inclined groove cut in it, acting on a screwed pin connected with the inner tube. This plan is more simple in construction, and less liable to derangement than the one commonly employed.

Our American Geysers.

THE two most wonderful geysers in the world, those known as "The Giantess" and "Great Geyser," are located in our National Park, on the Yellowstone River. Here, within an area of sixty miles square, in the north-west corner of Wyoming Territory, are collected such a variety of natural wonders, that, when the ways of approach are open, Americans will not need to leave their own country in order to view the grandest of all natural phenomena. Through one portion of this park flows the Fire Hole River; and it is in that part of its valley known as the Fire Hole Basin, that these Geysers are found. Here within an area of about five square miles may be found from twelve to fifteen hundred springs, with basins of all sizes, from a few inches in diameter to three hundred feet. These springs are of three kinds: 1. Those in which the ebullition occurs only at intervals, which are the true geysers; 2. Those which are constantly boiling; and, 3. Those which are in a state of repose.

The general appearance of these geysers is well shown in the illustrations on next page, though their grandeur and magnificence can never be even faintly appreciated unless they are seen in action. An eye-witness thus describes them:

"On a search for new wonders, leading

THE GREAT GEYSER.

THE GIANTESS.

AMERICAN GEYSERS.

us across the Fire Hole River, we ascended a gentle incrusted slope, and came suddenly upon a large oval aperture with scalloped edges, the diameters of which were 18 and 25 feet, the sides corrugated and covered with a grayish-white silicious deposit, which was distinctly visible at the depth of 100 feet below the surface. No water could be discovered, but we could distinctly hear it gurgling and boiling at a great distance below. Suddenly it began to rise, boiling and spluttering, and sending out huge masses of steam, causing a general stampede of our company, driving us some distance from our point of observation. When within about forty feet of the surface it became stationary, and we returned to look upon it. It was foaming and surging at a terrible rate, occasionally emitting small jets of hot water nearly to the mouth of the orifice. All at once it seemed seized with a fearful spasm, and rose with incredible rapidity, hardly affording us time to flee to a safe distance, when it burst from the orifice with terrific momentum, rising in a column the full size of this immense aperture to the height of 60 feet; and through and out of the apex of this vast aqueous mass, five or six lesser jets or round columns of water, varying in size from six to fifteen inches in diameter, were projected to the marvellous height of 250 feet."

The Great Geyser, as shown in the illustration on the preceding page, differs from the Giantess, in that its action is more violent. With scarcely any preliminary warning, a volume of hot water, eight feet in diameter, is thrown up to the astonishing height of 200 feet. So steady and uniform does the force act, that the column of water appears to be held in place for some minutes. This violent action takes place at regular intervals of about thirty-two hours.

Ornamental Turning.

TO the novice in ornamental turning, the more simple the apparatus to commence with the better, and it will be advisable not to have too much in the shape of instruments to begin with; if this is the case, they all come in for a small share of patronage, and little or nothing is done with any. In order to give the tyro some idea of the best means of fitting up a workshop, and using its contents, we propose detailing here the necessary items to commence with. First, then, we must have as a groundwork, a good lathe, and the one we recommend will be a 5-inch centre, with a traversing mandrel. This is not absolutely necessary, because, by practice, it is not a very difficult process to cut a screw without its aid, but as there are times when its use will save a deal of trouble, we certainly advise it. As an instance of its use, take the lid of a snuff-box, which is so short as a rule that it becomes a very difficult matter to insure a true thread, and as blackwood and ivory are so expensive, it is policy to save it at all risks. This, however, must remain with the person who is about to invest his money in one of these interesting instruments, and from what we have lately seen of their productions, it cannot be wondered at that so many are devoting their attention to it. Having obtained a lathe as described, if quite a novice, it is a great advantage to become efficient in plain turning before aspiring to the ornamental branches. When sufficiently expert in the use of the gouge and chisel, attention may be turned to the higher branches, and we have found that the best way to proceed is to first procure a good slide-rest fitted with a metal cradle and stops, to place the T of the slide to turn a true surface or cylinder. This is very essential, as it saves the trouble of adjusting the slide at each movement. An over-head-motion is now made with two cast-iron standards with triangular bar at the top, and a round bar with pullies on a drum. On it, revolving between two steel centre screws on the top bar, is fitted a carriage in metal, through which passes an iron bar with a cast-iron ball on the end, adjustable as to distance. This is to form a counterbalance to alter the tension of the band upon the various instruments. On the front end are two guide pullies to conduct the band to its position. The lathe now begins to assume the form of an ornamental turning one; a few more additions, and we make a start—an eccentric

cutter, a drilling instrument, a vertical cutter, and a few tools for each. We may now in reality begin to work, and with such an assortment of tools as named, much beautiful work may be done. As to what it will do, it is a difficult matter to explain by pen all or any of the different objects to be produced; but as an example for a tyro, let us set about making a box in cocus or blackwood, or even boxwood, which is sufficiently good to practice upon in case of a failure, which is not at all improbable at the commencement. The box is about three inches in diameter, the lid having been faced over with a fixed tool in the slide-rest. Remove the tool, and in its place substitute the eccentric cutter, set out the eccentricity about one-half an inch and it describes a circle of one inch. Use the 96 division on the dividing-plate, place in the eccentric cutter a double angle tool of 35°, and cut deep enough to bring the pattern up sharp, and what is called the "barley corn pattern" will be the result, and if well executed, cannot fail to be satisfactory to the operator. So far so well; but this will not be enough to cover the surface of the box-lid. About $\frac{1}{8}$ of an inch from the inner side of the pattern place a row or circle of beads, which must be done with a bead-drill, and in the centre cut another eccentric pattern, and we think a very pretty effect will be obtained. We need scarcely say that the style of pattern, although done with the same tool, may be altered to almost any extent. Having finished the lid of the box, which is, or should be, fitted on the bottom, instead of a chuck, the side or cylinder part must be turned, and a very good illustrative pattern is that produced by the vertical cutter, thus: Set out the radius of tool to cut about a 2-inch circle, and then cut until the cut represents about $\frac{3}{4}$ of an inch, and take such a division on the plate that will bring each edge up to a sharp point. Having cut all round, take, say, two divisions on the plate, and move the slide-rest just the width of the tool, and cut again, using the same division, only starting two in advance of the previous cut; repeat this the length of the box, and another very effective result is obtained, and it will appear in a spiral form. This pattern is usually called the basket pattern. When this is done, the lid may be removed and the inside of the box turned out. When this is accomplished cut off the bottom, turn a boxwood chuck to fit it, and so hold it while the base of it is turned flat, and by way of practice another pattern may be cut upon it.

To be continued.

Editorial Notes.

Our Amateur Workshop.

IN the present number we publish the first of a series of papers, which are to be continued, entitled: "Three Amateur Workers—And What They Did." The object of these papers will be to show the young reader how to care for and use edge tools, and to give easy lessons in the art of making kites, æolian harps, hand-sleighs, small wagons, hanging cabinets, girl's work-boxes, doll's furniture, and a hundred other things that clever little folks *can* make if they receive a little help. Little girls will also find many things in these papers that will both amuse and instruct them, as a play-house, furniture, dolls and all, will be introduced. Foot lathes, scroll saws, and what can be done with them, will be talked of and discussed.

Correspondence.

Preserving Flower-Stakes from Rot.

Ed. Young Scientist.—Nothing is more annoying than to find, after a strong wind, some of your finest flowers blown down because the stakes have rotted off at the surface of the ground.

I have now in my possession flower-stakes which have been in constant use for over nine years, and their points are yet perfectly sound and good. I take common coal-tar and bring it to the boiling point in a kettle some 10 to 12 inches deep; I then place the lower part of the stake in the boiling tar, immersing it as deeply as the pot will allow. After they have remained therein about ten minutes, I take them out, allow the surplus tar to drain off, and roll the tarred portion in clean sharp sand, covering

every part of the tar. After they have become perfectly dry, I give them another coat of tar, completely covering the sanded part. Then, after being thoroughly dried, they will last for years. Some of them I have painted three times with lead and oil paints on the upper part, and they are ready for the fourth, while the lower portion is still sound and good. To treat a lot of stakes in this manner costs but little and pays well, as it saves a great deal of future labor and annoyance. H.

He'll Never Set the Thames on Fire.

Very few know the origin of this common phrase. Many years ago, before machinery was introduced into the flour mills for the purpose of sifting flour, it was the custom of the miller to send it home unsifted. The process of sifting was done thus, but principally in Yorkshire: The temse, or sieve, which was provided with a rim which projected from the bottom of it, was worked over the mouth of the barrel into which the flour or meal was sifted. An active fellow, who worked hard, not unfrequently set the rim of the temse on fire by the force of friction against the rim of the flour barrel, so that in fact, this part of domestic employment became the standard by which to test a man's will or capacity to hard work; and thus of a lazy fellow, or one deficient in strength, it was said, "He will not set the temse on fire." The long disuse of the word "temse" for sieve, as well as superseding of hand labor by machinery in this particular species of work, may possibly have tended to the substitution of sound for sense, in such phrases as "He will never set the Thames on fire," the North River on fire, or any other river.

Coloring Ivory and Bone.

To Color ivory or bone red, take 4 grms. of picric acid, and dissolve in 250 grms. of boiling water; add, after cooling, 8 grms. of liquid ammonia. Dissolve also 2 grms. of crystallized fuchsine (magenta) in 45 grms. of alcohol, dilute with 373 grms. of hot water, and next add 50 grms. of ammonia. As soon as the red color of the magenta solution has disappeared, the two solutions are mixed together, making a bulk of liquid amounting to about one-half litre, which is a sufficient quantity for dying from four to six sheep's skins. Ivory and bone should be placed in very weak nitric or hydrochloric acid first, before immersion in the ammoniacal liquid; wood can not be dyed by this liquid unless it has been previously painted over with paste made from flour. When to the ammoniacal liquid some gelatine solution is added, it may serve as a red ink, which does not attack steel pens. By varying the proportion of magenta and picric acid the tints obtained may be varied from a blueish red to a bright orange red. The desired colors do not appear until the ammonia is evaporated. This solution may be used for either ivory, bone, or horn.

Practical Hints.

Artficial India Rubber.—It is said that a cheap and useful substitute for India rubber is prepared by mixing a thick solution of glue with tungstate of soda and hydrochloric acid. A compound of tungstic acid and glue is precipitated, which at a temperature of 86° to 104° Fahrenheit, is sufficiently elastic to admit of being drawn out into very thin sheets, which, on cooling, become solid and brittle, but on being heated again, soft and plastic. It can be used for many of the purposes to which rubber is adapted.

A Forgotten Color.—The simple decoction of onion-peel is said to produce upon glove-leather an orange-yellow superior in lustre to any other. It is also said to be suitable for mixing with light bark shades, especially willow bark, and as a yellow for modulating browns. The onion-dye is said to fix itself readily, even upon leathers which resist colors, and covers them well and even. Dr. Reimann seems, however, almost as sceptical of the tinctorial power of onions as of truffles.—*Chemical News.*

Glass Cement.—A cement to stop cracks in glass vessels, to resist moisture and heat, is made by dissolving casein in a cold saturated solution of borax. With this solution paste strips of hog's or bullock's bladder, softened in water, on the cracks in the glass, and dry at a gentle heat. If the vessel is to be heated, coat the bladder on the outside, just before it has become quite dry, with a paste of a rather concentrated solution of soda and quicklime, or plaster-of-Paris.

To Harden Plaster-of-Paris.—By adding 3 to 4 per cent. of powdered marshmallow root to plaster-of-Paris, the resultant mass, in about an hour after setting, will be found to have acquired such a degree of hardness that it may be sawed, turned, etc. Prepared in this way, the plaster is found to afford an excellent substitute for bone or ivory in the manufacture of buttons, dominoes, dice, etc. If the amount of marshmallow is increased to 8 per cent., the mass acquires such hardness that it may be rolled out into thin plates, which may be painted, polished, and varnished.

Tool Chest.—The chest should be long enough to take a ripper-saw inside the saw-till, say 29 inch clear. A good plan is to rip the boards down and glue and tongue them, heart-edge and sap-edge together. The tills may be made of yellow

pine. Oak, which is sometimes used, is heavy, and seems to have a tendency to rust the tools. The runners may be of oak or other hard wood, capped with whalebone. Pine is most suitable for the tills if the maker intends to veneer the inside.

Black Coating for Zinc.—Dingler's *Polytechnic Journal* states that M. Neumann has instituted a series of experiments to point out the best material to produce upon statuary or ornamental objects made of zinc a pleasing blackish coating, without impairing the effect of the natural color of the metal, as would be the case when an oil paint or varnish is used. The best results were obtained when nitrate of protoxide of manganese was employed. This salt, on being heated, is decomposed, yielding black peroxide of manganese, and the degree of heat required is not so high as to affect the zinc. The best solution for this purpose is fifty-four grammes of the salt in one litre of water.

Preservation of Paste with Salicylic Acid. The souring and molding of paste used by bookbinders and workmen in other trades, which, according to circumstances, occurs in about two or three days, may be entirely avoided, according to the statement of Herr P. Lung, by the addition and thorough mixture with the freshly-prepared paste of a few drops of salicylic acid. When thus treated, a paste may be kept for weeks in a heated room without losing its freshness, and even when it has by long standing become dry and tough, may be at once rendered fluid and serviceable by treatment with hot water. The addition of the acid does not, according to this author, affect the stickiness of the paste to any sensible degree. The above item will, doubtless, prove serviceable likewise to all who have only occasionally to make use of paste.—*Gewerbeblatt aus Wurttemberg.*

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business letters or cards they cannot be used.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

Will exchange, for printing outfit or shot gun, 6 years Nos. of Scientific American, with Supplement of 1876, 545 foreign and U. S. stamps, Art of Swimming, Instruction in Shorthand, and other books. W. A. Smith, West Randolph, Vt.

Good Specimens of the 17 years' locust (17 year cicada), in exchange for any kind of insects, beetles, moths, or butterflies. Harry C. Beardslee, Painesville, Lake Co., Ohio.

Insects and butterflies from China; state what is offered in exchange. Edward Laurent, 621 Marshall St., Philadelphia, Pa.

I have a four-legged and four-winged one-headed chicken, in alcohol, which I should like to exchange for a good breech-loading shot gun, or for standard scientific books. A. H., Box 500, Albion, Ohio.

Wanted, scientific books, minerals, fossils, and Indian relics, in exchange for minerals, fossils, coins, old Continental and Federal money over one hundred years old (very rare), foreign stamps. A. W. Baily, Box 712, Atlantic City, N. J.

Birds eggs, books, foreign stamps, a good hammock, and revolver, to exchange for birds eggs and works on birds. F. D. Brown, Gallupville, Schoharie Co., N. Y.

A magic lantern with eight slides, cost $5, and other things, to exchange for scientific books, chemicals, or chemical apparatus, etc. A Campbell, Box 31, Derrick City, McKean Co., Pa.

Idaho Mineral Specimens, for bound books on science, travels, history, biography, political, masonic, and others that are instructive. J. P. Clough, Junction, Lemhi Co., Idaho.

I have minerals (including fossils and dentrites), to exchange for minerals; also a papyrograph outfit, without press (worth $25), for offers. W. H. Eastman, Hyde Park, Mass.

Craig's Simple microscope and three objects, $2.50; 155 rare stamps in small album, 1 font of type; "Illustrious Mechanics," $1; "Northern Lights," $1.50; for coins and curiosities. Geo. K. Fischer, 729 North 6th St., Phila.

Klose's celebrated "School for the Clarionet," new, $3; will enchange for telescope, microscope, piccolo, books, or offers. Rush Holbrook, Wonewoe, Juneau Co., Wis.

One or two handsomely mounted red deer heads, attractive ornaments for any dining-room or hall, for microscope, telescope, sporting implements, camping outfit, scientific books, or offers. R. B. Hough, Lowville, Lewis Co., N. Y.

A new E-flat solo cornet, cost $22, for a self-inking printing press and outfit of same value and condition, also B-flat clarionet, books, papers, magazines, etc., for offers, C. W. Hughes, P. O. Box 96, Shreve, Ohio.

Hope's Manual of Sorento and Inlaid Work, cloth edition, price $1.25; would like to exchange for books on aquaria postage stamps, hammocks, or almost anything. G. Keppel, Zeeland, Ottawa Co., Mich.

A new one horse power horizontal steam engine, in complete running order, worth $60, for a first class coal stove, watch, or offers. Geo. L. Lamson, La Fargeville, Jeff. Co., N. Y.

A handsome Young America self-inking printing press, chase 3½ x 4¾ inch, with 5 founts of type, 300 cards, and outfit complete, for a good wood-turning lathe, or offers. E. McLean, 443 Clermont Ave., Brooklyn.

Telescope, microscope, drawing instruments, and other things, in exchange for printing press and outfit, or offers; wanted, cards, type, etc. Ewing McLean, Greencastle, Ind.

I should like to exchange birds eggs with any one living in the far West, South, or in foreign countries. Wallace Ross, Lock Box 97, Rutland, Vermont.

I have some good specimens of Pentremites from the sub-carboniferous formation, that I would like to exchange for books. H. Russell, Grassy Cove, Cumberland Co., Tennessee.

Bonanza printing press, with three fonts of type, and assortment of blank cards; value of outfit $7.25; would like rifle, books, or offers. Geo. R. Simpson, Janesville, Bremer Co., Iowa.

Fine cabinet for sale or exchange; polished walnut and maple, 27 drawers, 3 closets, all locked; 7 ft. x 5 ft. x 19 inches; for any kind of specimens. W. W. Stockton, Box 190, West Chester, Chester Co., Pa.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

VOL. III. NEW YORK, OCTOBER, 1880. No. 10.

Cheap Lathes and How to Use Them.

A RECENT writer on Amateur Mechanics tells us that Turning is "beyond all doubt the chief of the Amateur Handicrafts," and no one whose judgment is of any value will dispute it. Fortunately, at the present day cheap lathes are quite common. Some years ago no lathe in market was sold for a less price than $50 to $100; to-day, we have many that range as low as $5, and yet are capable of doing valuable work. Some time ago a friend of ours had one of these cheap lathes given to him. He showed it to an acquaintance who was a first rate mechanic, and was advised to send it to the junk shop as being good for nothing. On receiving such advice, he naturally felt that the art of turning was not an occupation for him, and he was about to get rid of his seemingly worthless present, when he happened to meet another friend, who, fortunately, was quite as skillful, but not quite as "aristrocratic" in his mechanical ideas. This friend spent an evening with him, put the lathe together, and adjusted it, fixed the tools and sharpened them up. He then took a piece of common wood, which he found amongst the firewood, sawed it rudely into shape, put it in the lathe, and in a few minutes he turned out a handsome little vase, which he presented to the astonished wife of his host, and it now stands on her mantelpiece as one of her choicest ornaments. Her husband, meantime, stood looking on in amazement; he had been told that his lathe was fit only for the the junk shop, and here was a quiet, unobtrusive man using it to make articles of great beauty, such as vases for the mantel-piece, and of usefulness, such as handles for tools, etc. Next day, when he went down town, he wrapped the smoothly turned and finely polished vase in soft white paper, and took it with him. He showed it to his aristocratic friend, told him it was a present he had just received,

and wanted to know what he thought of it. The friend thought it beautiful, and praised the skill of the workman. After some further chatting, it was agreed between the friends that the man that turned that vase must not only be a good turner, but he must have a good lathe. When it leaked out that the vase had been turned in the cheap and "worthless" lathe, the reply was: "Well, he may have turned that thing in it; anybody could do that, but he cannot turn anything that is really worth turning!" The owner of the lathe had nothing to say to this. If it would turn such simple things as vases, handles, brass knobs, and screws, and the thousand and one little odds and ends, which every amateur mechanic needs, it would serve his turn very well *until he could get a better*.

We relate this anecdote, which is true in every particular, for the purpose of teaching our young readers that these cheap lathes are good and useful tools, and that they may be used to very good advantage for many kinds of work. It is true that there are many things which are beyond their reach, but this is also true, to a certain extent, of far better and more expensive lathes.

It is not very difficult to learn to use these simple lathes. Turning is an art not so easily learned as fret sawing, planing and many other departments of amateur handicraft. But it is easier to learn to use the lathe than to learn to use the file, or the art of the cabinet maker; and small work does not require any greater exertion of strength than is needed for operating the sewing machine. Hence, turning is an art which is well adapted to the use of girls as well as boys, and which is often quite as useful to them as we shall show hereafter.

During the past ten years, cheap lathes have become quite common, but, unfortunately, while we have simple books on amateur scroll and fret sawing, on engraving, and other arts, the only books on turning that we know of, are beyond the reach of boys and girls, from the simple reason that the lathes described are too expensive, and the work is of a higher grade than most amateurs have the skill to turn out. We propose, therefore, in our next twelve issues, to give a series of articles which we hope will enable our readers to acquire a respectable degree of skill in this delightful art.

We shall not enter into the intricacies of oval and eccentric chucks, but we can easily teach them how to use the common tools, and to turn up such pieces of brass, iron, wood, bone, ivory, etc., as are used in the making of ordinary apparatus and the performance of common experiments.

Three Amateur Workers—and What They Did—II.

BY FRED. T. HODGSON.

It took Mr. Carpenter some time to decide whether he would buy good tools, and pay a fair price for them, or buy cheaper ones; being a sensible man, however, he avoided the mistake of buying poor tools because they are cheap. He purchased good tools, not fancy or flashy ones, but such as could be depended upon to do good work with, when properly handled; and here let me say to parents and others who buy tools for young folks, that it is very unwise to purchase inferior tools, for the trained and skilled artisan finds it almost impossible to make a good job with them, and how much more difficult it must be for a young amateur to make respectable work with such inferior appliances.

A sufficient number of tools for present purposes was bought, and ten dollars were expended for a load of dry lumber, of such dimensions and quality as he thought would be most useful.

A space in the stable, that had been used for storing away a lot of useless furniture, stoves, pipes, and other things, was cleaned out, and a very respectable workshop, about twelve by sixteen feet, was marked off, and given over for the boy's use. This, of course, made a much larger workshop than was necessary, but Mr. Carpenter thought, as he had the room to spare, that it would be as well to make it large.

The boys had evidently hurried home from school, for they arrived earlier than

usual, and immediately hastened to the stable to see the tools and lumber their father had bought; and Ellwood fairly yelled with delight when he saw the brightly polished saws, chisels, and bits. He had a thousand questions to ask concerning the tools, and so rapidly were they put, that before his father could answer one, two others were asked. "How much did you give for the four saws, Pa?" said Ellwood. "I gave five dollars and a quarter for them, but I believe they are worth more, or at least more is asked for them if they are bought singly, but, you see, I bought a number of other tools in the same store, and got them a little cheaper on that account," said Mr. Carpenter. "What do we want the two big saws for?" said the boy. "Why," said Mr. Carpenter, "One of them is for cutting boards across the grain, and is called a 'cut off' or cross-cut saw, and the other one is for cutting boards lengthwise or with the grain, and is called a rip-saw; you will notice that it has much larger teeth than the "cross-cut" saw, and that the teeth have more "hook," and are filed square across. Four teeth to the inch is about the average for a rip-saw, and eight to the inch for a "cross-cut"* The

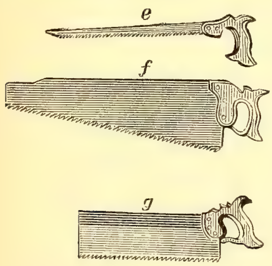

Fig. 1.

small saw with the iron rib on the back, is called a sash saw, by some workmen, by others it is called a "tenon saw." This last name is the proper one, and I wish you to remember that. The tenon saw has about fourteen teeth to the inch, and is filed very nearly the same as a cross-cut. The long narrow saw is called a "compass saw," and is used for cutting circles from four inches to two or three feet in diameter. It has about the same number of teeth to the inch as a "cross-cut saw," but is filed squarer across the tooth, but not so square as a rip saw. There are quite a number of other kinds of saws than the ones I have bought, but we do not require them at present, when we do I will get them and describe them and their use, so that you will know what they are for and how to work with them."

"Come boys," said Mr. Carpenter, "we must now go to work and make a carpenter's bench and two saw horses. Ellwood, you bring into the shop one of those pieces of scantling that is 2 by 4 inches."

"What do you mean, Pa, by 2 by 4 inches?" said Ellwood.

"I ought to have explained this matter before, my son, but it is not too late yet. Two by four inches means any piece of wood or other material, or space, whose dimensions are two inches on two sides, by four inches on the other two sides, regardless of length. All scantlings and timbers are measured this way, so that you will know after this what is understood when timbers or scantling are spoken of as being 2 by 4 inches, 4 by 6 inches, 3 by 10 inches, or any similar dimensions. Well, this being explained, let us proceed to work. We want four legs or standards for the bench, and eight legs for the two saw horses. Legs for the saw horse must be cut twenty inches long; you will see the 20 figured on the rule (Fig. 2). Be careful and have the legs all cut to one length. Now we want two top pieces for the horses, cut from the same kind of scantling. They want to be two feet six inches long. Now then, lay all the legs in a row close to each other with the ends all in line; now lay one of the top pieces flatwise on the legs with one of its edges on the line of the ends of the legs, then mark with a lead pencil along the other edge, on the legs, and we have a line cutting across the flat sides of the

*f, Shows the shape and style of both cross-cut saw and rip-saw. The cross-cut saw generally has a blade about twenty-four inches long. The rip-saw blade is about twenty-six inches long.
g, shows a tenon-saw with a blade about sixteen inches long.
e, shows a compass saw with a blade about twenty inches long, and about one inch wide in the centre.

legs at four inches distant from the ends, from this mark take off the wood, leaving the end about one inch thick. This will give the legs the right 'spread.' Nail the

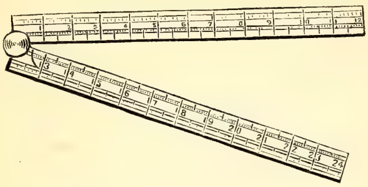

Fig. 2.

tapered ends of these legs fast to the top-pieces, and about three inches clear from the ends of the latter. When this is done, and the horses are solid on their legs, nail short inch boards across the legs with the upper edges put close under the top

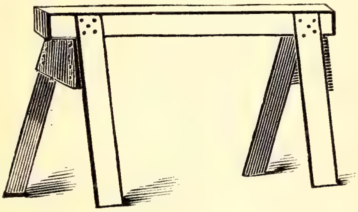

Fig. 3.

pieces. These pieces act as braces for the legs, and supports for the top pieces. Now, boys, we have two good saw horses. here is one of them shown in Fig. 3. You have done well!"

"Now then for the workbench! We want four legs cut off, two feet four inches long, and made of stuff 4 by 4 inches. Two feet six inches—which will be the height of the bench when completed, on account of the two inch top—is rather too high for you boys, but, as I may want to use it myself sometimes, it is better made high enough now, and you boys can put a plank on the floor when you want to use the bench to raise you high enough to work with ease.

The legs being cut, it is now necessary to cut the cross pieces or bearers. We want five of these: they require to be one inch thick, twelve inches wide, and three feet long. Mind and cut them off square at the ends, and have them all exactly of the same length."

"There, children, I think that will do for this evening, we will complete the workbench to-morrow evening, after you arrive from school."

The boys were anxious to keep at work, but Mr. Carpenter told them that it would be best not to do too much at once, or they might get tired, and not care to work at all.

(To be continued.)

A Breakfast for a Whale—What it Was, and How it was Got—II.

BY A. W. ROBERTS.

Concluded from page 103.

FIRST I visited the "Captain's," and eat as hearty a meal as I could, for I began to suspect that I had some hard work before me. Then to Pyne's, to read up on white whales; and after that to the Fulton Market fish stands, to find out the nearest fishing station, and if I could reach it in time for a catch.

The first man I spoke to informed me that Barnum's folks had been to the market that morning, trying to obtain a hundred pounds of live eels, but that at that season of the year all the eels came to the market packed in ice. I asked why other kinds of fish were not just as good as eels, and he informed me that eels were best, because they lived a long while, and had soft fins, whereas a sea bass or black fish would be apt to stick in the gullet of a whale and choke him. This agreed exactly with the conclusions I had reached up to this time. I gave him a cigar and several passes to the museum, and then asked more questions. I found that the nearest fishing station was Unionville, Gravesend Bay, and that Ed Morris was the most reliable man to go to; that the tide was in my favor, and that I would be in time to catch the stage from Greenwood to the bay.

When I reached Greenwood the stage had gone. After a long talk, I coaxed (with money) one of the cemetery hackmen to drive me at full speed to Unionville.

My heart fairly bounded as I passed

through this pleasant little hamlet, at the sight of the tarred netting hanging on every fence, and I felt that success would be mine. I found Ed Morris, who sent out runners to all the eel pot fishermen to secure every eel. After hiring a man and a boat, and instructing him to secure all the lafayettes and codlings from the three nearest fish traps, and telling them to fill the boats with water to keep the fish alive till reaching the shore, Morris and I started for the fourth "pound" or "trap," with an extra boat to bring in all the live fish obtainable. I had never seen a "pound" lifted before, and when I saw the great solid moving masses of many varieties of fish I became silent. It would be difficult to exaggerate the effect produced on my mind. It was not merely respectful attention—it was the passionate enthusiasm which a sensitive person shows when brought in contact with the new, strange, and irresistible influence produced by Nature's great works.

Returning to the shore I began to arrange the boats for the voyage to New York. Four boats were hired to transport the live fish in, and five small boys to sit at the bow of each boat to bail water in and out. I and the fifth boy were extras to relieve the others when tired.

I had much trouble to obtain the tin cans, there being no tin store in the village, and the fishermen's wives disliking to part with their tinware; but by offering double the value, I managed to obtain six pails. This gave me two extra ones, in case my bailers lost any overboard.

All the boats were now in with their cargoes of live fish in excellent condition. These boats were connected together with strong towing ropes, some twelve feet apart, and these were to be attached to the towing sail boats.

The tide by this time was rolling in fast; and noticing that one of the boats was in danger of being swamped, I dashed into the water, clothes and all, and by rapid swimming reached the boat before the fish escaped. Up to this time the many fishermen assembled on the beach, watching this curious exhibition, had fought shy of me, evidently thinking I was a Broadway fisherman; but when they saw those stylish pants and boots swim out, they seemed to accept me as a true water dog. The package of passes were well soaked, so I distributed them to the fishermen as peace offerings. The previous jesting remarks that the young fishermen had indulged in ceased after this, and strong brown arms were ever ready to haul, pull, and help in every way.

The boats containing the live fish were covered over with netting, except at the bow, where a small space was left for the boy to sit, who was to bail water in and out. Each boy was instructed that in case his boat filled, he was to jump overboard, and relieve the boat, until she could be lightened, by bailing out water.

All was now ready for the start. Two of the largest market sail boats were hired to tow the four boats of fish, which, when strung out in line, presented a very odd appearance, with a boy sitting in each boat bailing water. It took me some time to find part of my clothing, as I could not remember where I had thrown them off during the excitement, but I recovered all but my kid gloves, handkerchief, and necktie.

It was now late in the afternoon. The tide being in our favor, and a fair wind, we ought to reach the city in good season. So, going on board of one of the sail boats, we sailed out of the bay amid cheers and showers of dead fish. All went well till we got past Fort Hamilton, when a tug boat suddenly crossed our bows, and we were forced to take her swash. One of the boats filled immediately, but the bailer was overboard in an instant, and she righted. Jumping overboard, I passed down to the boat that had filled, and helped the bailer to lighten her up. All the fish were doing well, showing no signs of distress.

It now being about tea time, each boy was relieved to come aboard the sail boats and take a hearty meal which I had provided. While I was taking my tea, one of the boys filled his boat too full, and she swamped; and the boy, in jumping, nearly turned her over on top of him, on account of his holding on to the gunwale of the boat, when he ought to have grasped

the tow line. In an instant I was overboard and righted the boat. On we went, hugging the inshore, to keep clear of passing vessels, amid cheers and salutations from shore and dock. I was overboard quite often, but being perfectly at home in the water, I did not mind it much. The only part of the voyage I feared was the ferry boats, when we reached New York city. Fortunately, the teams and hogsheads to take the fish to the Museum were to be in waiting at Castle Garden.

When rounding Governor's Island, I espied one of those hugh black tug boats heading right for us. We dared not run across her bow for fear she would run us down; so there was nothing left to do but to wait until she passed us, and take her swash. In a few seconds after passing, we could see the big rollers heading directly for us. In an instant all four boats filled; overboard I went, but a big wave caught me, carrying me some distance past the boats. I could see one of the boats bottom up, and I made up mind that one lot of fish had escaped. With most vigorous swimming I seemed to gain but little on the sail boats; but at last they lowered sail, and I overtook them. With the aid of all the boys we managed to right the capsized boat, and, to my astonisment, all the fish were safe. The netting had saved them.

No accident occurred after this, and we reached Castle Garden in safety, and in a short time the fish were on the way to the Museum.

There, in the huge tank, lay the white whale in a pool of water, squealing like a young pig. (They make a peculiar squealing noise when out of water.) The live fish were carefully lowered into the water, and with the eels made a great show. The fishermen and boys who helped me through, visited the Museum through the day, and gave Barnum and my Eastern friend a vivid account of my hardships and adventures, so that in their estimation I was a great fisherman.

Reaching home at four o'clock in the morning, I awoke my mother, and told her all of my adventures, and when I came to the lost and spoiled clothing, I could not help but exclaim: "Why! mother! nobody knows the trouble I've been through, just to obtain a supper for a whale."

This was my first great lesson in "Do fish feed by suction?" How often I have heard that word used by dealers when a customer asked, "Did the fish need feeding?" Their answer was "No, ma'am, they exist on 'suction,' or what is in the water." And there are thousands of people at the present day who still hold that fish live on "suction." I know of a person who has had charge of thousands of fish living in aquaria, and who up to two years ago argued that he had made an especial study as to how often fish required food, and that he *knew* they could live without food for long periods of time, and not look or be any the worse for it. I was once connected with an establishment where this theory was firmly established—that the fish needed to be fed only two to three times a year. The fish were in a most wretched condition, many of them so weak that in attempting to swim they wobbled from side to side. The crabs were chewing each other up. I have seen the lobsters lay on their backs all night, snapping with their claws at the fish above them. Even for months the toughest and most hardy of fish were dying every day. At last I begged of the proprietor to allow me to feed the fish. The first day I gave them five hundred clams, twenty pounds of beef, ten pounds of fish, large quantities of ulva and enteromorpha for the vegetable feeders, one half bushel of snails, and four quarts of shrimp, and I could have fed out double the quantity. That night I examined the lobsters—they were all in bed and not snapping and clawing at their neighbors. The black fish, who, previous to this feed, had the wobbles so bad, and were afraid of being eaten up by each other, now had both strength and courage to come forth and form into a school that went circling round and round the immense tank in beautiful style. The star fish gave up cannibalism and took to eating the snails. The sea urchins and hermit crabs devoured immense quantities of the enteromorpha.

When collecting on the Massachusetts coast, I often visited the fishing smacks, for the purpose of examining the contents of the stomachs of various kinds of fishes. I always found them packed solid with food. Why do fish go to all the trouble of eating the different kinds of fish if it is not for some good purpose—to sustain life. Why have they teeth if they are not of any use?

When at Barnum's, the fish were fed at three o'clock; at that time they became uneasy, and at the first stroke of the chopping knife on the feeding board, every fish was to the front of his tank, often pressing their noses against the glass. The crabs would become frantic and scramble all over the rockwork, searching for their food. Our greatest anxiety with new fish was to get them to feed, then we considered they were out of danger.

Alfred Lloyd, of the Crystal Palace Aquarium, London, who, I consider, is the very best authority on aquaria, feeds to the animals contained in the tanks thousands of pounds of food yearly, consisting of thirteen kinds—both animal and vegetable.

Home-made Telescopes and Microscopes.—X.

NEW FORMULA FOR A MICROSCOPE OBJECT-GLASS BY MR. WENHAM.

A PENCIL of rays exceeding an angle of 40° from a luminous point cannot be secured with less than three superposed lenses of increasing focus and diameter, by the use of which combination rays beyond this angle are transmitted, with successive refractions in their course, towards the posterior conjugate focus. Until quite recently, each of these separate lenses has been partly achromatized by its own concave lens of flint-glass, the surface in contact with the crown-glass being of the same radius, united with Canada balsam; the front lens has been made a triple, the middle a double, and the back again a triple achromatic. This combination, therefore, consists of eight lenses, and the rays in their passage are subject to errors arising from sixteen surfaces of glass.

In the new form there are but ten surfaces, and one concave lens of dense flint is used for correcting four convex lenses of crown-glass. As this might at first sight be considered inconsistent with theory, a brief retrospect of the early improvements of the microscope object-glass will help to define the conditions. The knowledge of its construction has been entirely in the hands of working opticians; and the information published on the subject being scanty, this has probably prevented the scientific analyst from giving that aid which might have been expected.

Previous to the year 1829 a few microscopic object-glasses were made, composed of three superposed achromatic lenses; but this combination appears to have been used merely with the intention of gaining an increase of power in ignorance of any principle, and without even a knowledge of the value of angular aperture.

At this time the late J. J. Lister tried a number of experiments, and discovered the law of the aplanatic focus, and proved that, by separating lenses suitably corrected, there were one or two positions in which the spherical aberration was balanced. This was explained in a paper read before the Royal Society in 1829. In the year 1831 Mr. Ross was employed to construct the first achromatic object-glass in accordance with this principle, which performed "with a degree of success never anticipated."

Mr. Ross then discovered that, after he had adjusted the interval of his lenses for the aplanatic focus, that position would no longer be correct if a plate of thin glass was placed above the object; this focus had then to be sought in a different plane, and the lenses brought closer together, in order to neutralise the negative aberration caused by covering-glass of various thickness. From this period the "adjustment" with which all our best object-glasses are now provided, became established. Fig. 14 is the form of object-glass used at this time, consisting of three plano-concave achromatics, whose foci were nearly in the proportion of 1, 2, 3.

No greater angle than 60° could be ob-

tained with this system in an $\frac{1}{8}$ objective (the highest power then made) for reasons apparent in the diagram. The excessive depth of curvature of the contact-surfaces of the front pair is unfavorable for the passage of the marginal rays; the softness of the flint-glass forming the first plane was also objectionable. In the year 1837 Mr. Lister gave Mr. Ross a diagram for an improved "eighth," having a triple front lens in the form shown in Fig. 15. By this the passage of extreme rays was facilitated; and in order to diminish the depth of curvature, a very dense glass was used, having a specific gravity of 4·351. Faraday's glass, having a density of 6·4, had been previously tried, but was abandoned on account of a difficulty in working it. The polished surfaces of both these qualities of dense glass speedily became tarnished by exposure to the air; and thus the dense flint concave could only be employed in a triple combination, that is, when cemented between two lenses of crown-glass: this form of front was kept a trade secret, and was not published in any work treating of the optics of the microscope. The front incident surface of the flint of the middle pair was made concave in order to reduce the depth of the contact; and for this reason only, as that surface has but little influence in correcting the oblique pencils, or in producing flatness of field, and may be a plane with an equally good or better result. "Eighths" of this form with angles of 80° were made, and remained unaltered till the year 1850, when larger apertures were called for, and Mr. Lister introduced the triple back lens.

The necessity for this will be seen by the diagram in Fig. 15, which shows that the contact-surfaces of the back achromatic are too deep, thus giving great thickness to the lens and limiting its diameter; dense flint would have remedied this to some extent; but its liability to tarnish rendered its use in a pair objectionable. The highest density at this time known, quite free from this defect, was 3·686. By means of the triple back, the final corrections were rendered less abrupt, a greater portion of the marginal rays could be collected, and the aperture of an "eighth" was at once brought up to 130° or more.

At this time the author (Mr. Wenham) had been making some experiments in the construction of an object-glass in the form of Fig. 15. Mr. Lister having favored his "eighth" with an examination, was good enough to communicate his late improvement of the triple back. No time was lost in giving this a trial, the result of which proved that excessive negative

Fig. 14. Fig. 16.

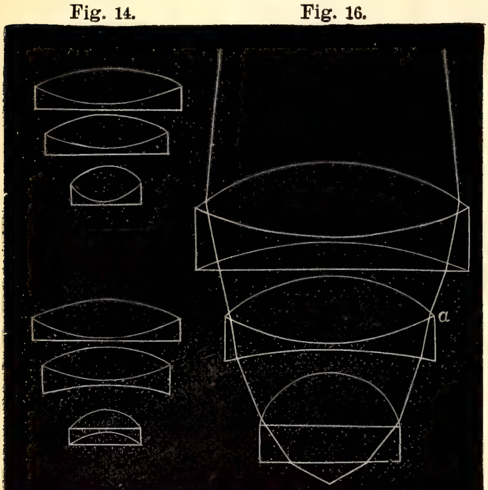

Fig. 15.

Fig. 17.

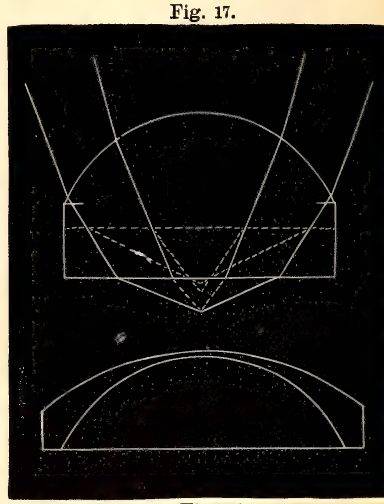

Fig. 18.

aberration or over-correction could readily be commanded with lenses of shallow, contact curves. During these trials all chromatic correction was obtained by alterations in the triple back; for it was found that the color-correction could not be controlled by a change in the concave surface of the triple front, as the negative power of the flint here appeared to be feeble, requiring a great difference in radius to give a trifling result. For this reason the front concaves were formed of very dense and highly dispersive flint; the cause of this was analysed by a large diagram, with the passage of the rays projected through the combination, starting from the longest conjugate focus at the back. This proved that the rays from that focus passed through the concave flint of the front nearly as a radius from its centre, or in such a direction that its negative influence was almost neutralised. It is well known that a lens may be achromatic for parallel rays, and under-corrected for divergent ones. The utmost extent of this condition was apparent in the object-glass under consideration.

This led the author to the idea of the single front lens of crown-glass, which gave a fine result at the first attempt, as the back combinations to which it was applied happened to have a suitable excess of negative or over-correction existing in the triple back alone, the middle being neutral or nearly achromatic. Still there was a defect remaining as positive spherical aberration; and this was afterwards cured by giving additional thickness to the front lens, which is now recognized as a most essential element of correction. In a "fifteenth," for instance, a difference of thickness of only ·002 of an inch will determine the quality between a good and indifferent glass. Fig. 17 represents a front lens suitable for bringing the back rays to a focus. The dotted lines indicate the effect of this difference, showing that with a lens of less thickness the marginal rays fall within the central, producing positive aberration as the result.

The single front introduced by the author (Mr. Wenham) is now used by every maker: for several years he could not induce opticians to change their system, though challenged by a series of high powers constructed on this formula for the purpose of proving its superiority. Fig. 16 represents the curves of the first successful "eighth" on this system, having an aperture of 130°, enlarged ten times. On tracing the passage of the marginal rays through the combination, it will be seen that, though the successive refractions are nearly equalized, the contact-surfaces of the middle pair are somewhat deep, though no over-correction existed or was needed here, for this would have required a shorter radius still (the density of the flint in this was 3·686). If this pair of lenses was not cemented with Canada balsam, total reflection would take place near the circumference of the contact flint surface, cutting off the marginal rays at *a*, and limiting the aperture. It might be argued that practically this would be no disadvantage, as these surfaces are united with Canada balsam, whose refraction is higher than the crown; so that the rays in this case must proceed with very little deviation. But incidences beyond the angle of total reflection may be considered detrimental, as they imply excessive depth of curvature; this can be discovered by looking through the front of an object-glass held close to the eye, any air-films in the balsam near the edge of the lens appearing as opaque black spots.

Science in Common-Place Things.—The Syphon.

IN our previous issue we stated that the author of "Physics Without Apparatus" not only used special apparatus in his experiments, but that in some cases he employed apparatus which could be procured only from dealers in philosophical apparatus. The engraving which we give this month, representing the well-known Cup of Tantalus, fully sustains this position. The Cup of Tantalus is, however, an illustration of such a useful instrument, that a short description of it will prove interesting and useful.

Many of our readers have probably read the story of Tantalus, whose name is embodied in our language in the word *tantalize*. Various accounts are given of the

reason for his punishment, and its form, but the one from which the common idea is derived is that of Homer, in whose poem (The Odyssey) Ulysses tells the Phæacians that in the lower world he had beheld Tantalus standing up to the chin in water, which constantly eludes his lip as often as he attempts to quench the thirst that torments him. Over his head grow all kinds of fruits ; but whenever he reaches forth his hand to take them, the wind scatters them to the clouds.

Our engraving represents the figure of Tantalus stooping down to drink the water which reaches almost to his lips, but as soon as the water rises to the level, A B, the concealed syphon, C, which is shown in dotted lines, begins to act, and the water immediately sinks just as it is about to rise within his reach.

The syphon is one of the most useful pieces of apparatus that we have, either in the hands of the amateur or the professional workman. It enables us to transfer liquids from a higher to a lower level, over obstacles which would otherwise cause great difficulty, and therefore it is well for our young readers to clearly understand the principles upon which it acts.

Two very distinct agencies are always at work in the operation of the syphon—the pressure of the atmosphere, and the weight of the water in the legs of the syphon. In the syphon shown in Fig. 2, the column of water in the leg, D, is longer, and consequently heavier, than the column in the

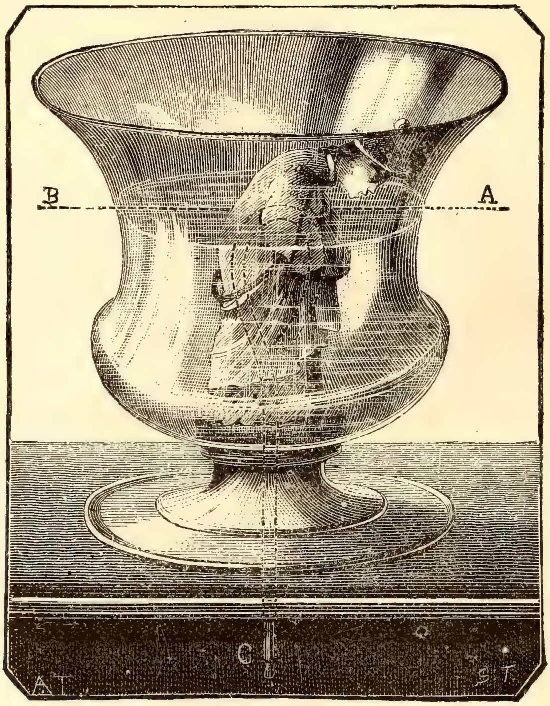

Fig. 1.—CUP OF TANTALUS.

leg E, and consequently it will overbalance it and fall down.

It is obvious, however, that the column of water from E to B is held in its position by the weight of the atmosphere pressing on the surface of the water in the vessel, A. If it were not for this pressure, the water in the syphon would separate at B, and fall down each leg, leaving the tube empty. But as fast as the heavier column in D falls down and escapes from C, the

water in A is forced up through E B to supply its place, and a constant stream is the result. It follows from this that under ordinary circumstances the point, B, cannot be raised more than thirty-two to thirty-four feet above the surface of the liquid in A.

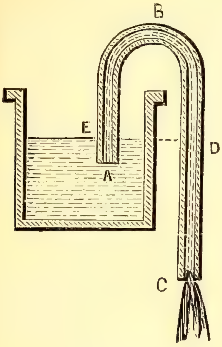

Fig. 2.

To those who keep an aquarium, the syphon is not only a useful, but an indispensable instrument. One of the best forms for this purpose is that shown in Fig. 3. It will be seen that the legs are of

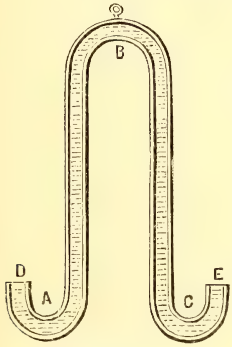

Fig 3.

equal length, and turned up at the ends. A syphon of this form may be filled and hung up on a nail until wanted, or it may be filled in a tub or tank, and then lifted out and placed in the aquarium. One of the objections to the syphon is the difficulty of starting or filling it, and this form obviates this to a certain extent. A syphon of the form shown has also the advantage that it does not disturb the sediment at the bottom of the tank, as a vertical pipe would do.

Practical Hints.

Adulteration of Coffee.—Prof. S. P. Sharples, State Assayer of Massachusetts, has been investigating the character of the ground coffee ordinarily put up in packages. He finds that peas, corn, oats, rye, etc., form the chief constituents. Fortunately he has not detected the presence of any positively injurious substances, and if people, who can easily find out the cost of a pound of green coffee, expect to buy a like quantity roasted and ground for half the price, they deserve to drink weak pea soup. For detecting adulterations he gives the following rules: "Take some cold water in a glass and throw upon it about half a teaspoonful of the coffee to be tested, stirring it around so as to wet the grains. Pure coffee will float and scarcely colors the water. Beans and chicory sink to the bottom. Chicory colors the water at once, beans more slowly. Test the part that floats by chewing it. Coffee will thus be recognized by its taste. Nut shells, which also float, are hard and brittle. A species of nut which has lately come into use strongly resembles coffee when ground up, by floating on the water as well as by its feeling between the teeth; but the difference can easily be detected, because the adulterating ingredient is nearly tasteless. After subjecting the suspected article to the above test, spread some of it out on a sheet of paper and examine it carefully for grains of rye, oats, and peas. The pea ingredient will frequently be found in pieces one-eighth the size of a pea, and the rye in half grains. Chicory is tough when taken between the teeth, and has a bitter taste, different from the bitter of coffee."

The Fair of the American Institute.—The managers of the American Institute have this year made an extra effort to increase the attractiveness of the fair, and the result is highly satisfactory. As usual the fair is specially attractive to the young, and forms, indeed, a school of object lessons of the utmost value as a means of practical education. Some people, who evidently do not appreciate the value of this feature, claim that everything that is in the fair can be seen elsewhere. True, but not in the same shape or so conveniently accessible. There we see everything presented in the very best manner, so as to show its peculiarities and the mode of its operation. By all means let the young folks spend hour upon hour at the fair. At no other place can they learn so much in such a short time.

Popular Microscopy.—Prof. Starr, of Westfield, N. J., who, as a lecturer, is well-known to be one of the most successful, at least so far as interesting popular audiences is concerned, has just returned from a trip to the West, where even in these exciting times he has found interested audiences. Sabbath schools and popular associations, who wish a really interesting and instructive lecture and exhibition, would do well to correspond with Prof. Starr.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business letters or cards they cannot be used.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

To exchange for 1 new Vol. II, Young Scientist, 1 new Vol. I of ditto, and Prof. Bell's Lectures on the Telephone. F. H. Burger, Chester, Pa.

Wanted, specimens metallic ores; will give in exchange fossil shells, Vicksburg epoch, Tertiary period; state kinds of ore. Philip Crutcher, Warren Co., Vicksburg, Miss.

I have 2,000 foreign stamps that I would like to exchange for others. F. Cushing, P. O. Box 178, Wattsburg, Erie Co., Pa.

An Official Printing Press, must be in good order, and type to make a complete printing outfit; state what is wanted in exchange. W. E. Cushman, Hartford, Ct.

Minerals, birds eggs, shells, woods, stamps, nests, books, insects, etc., to exchange for coins, stamps, minerals, birds eggs, insects, and fossils; send for my lists. Frank F. Fletcher, St. Johnsbury, Vermont.

Wanted to exchange 1 copy of Instruction in Wood Engraving, or set of dozen prints, suitable for practice, for specimens of algæ or minerals. S. E. Fuller, 25 Bond St., New York.

Wanted, copy of book called Corner Cupboard, and other scientific books; state what is wanted in exchange. G. S. Griffin, Emporia, Kansas.

I have some stamps which I will trade against other stamps, or offers; please send list of stamps you have to exchange. J., 226 West 22d St., New York.

A large number of books, papers, and magazines, to exchange for type, printing material, or offers. J. T. Jackson, Box 48, Metuchen, N. J,

Mosses from Germany, Colorado, and Illinois, also plants, Phænogamous and Crytogamic, to exchange for other mosses, lichens, liverworth, or algæ, East and South. Prof. P. Fr. Shuelke, Box 128, Pekin, Ill.

Wanted, a household microscope, telescope, large lenses, well-mounted slides for the microscope, books on the microscope or entomology, in exchange for stuffed birds or minerals; describe offers, and state what is wanted in exchange. E. O. Tuttle, Hampden, Mass.

Minerals to exchange for other minerals; state what specimens you have for exchange. Samuel Wynne, Box 54, Phoenixville, Pa.

Will exchange, for printing outfit or shot gun, 6 years Nos. of Scientific American, with Supplement of 1876, 545 foreign and U. S. stamps, Art of Swimming, Instruction in Shorthand, and other books. W. A. Smith, West Randolph, Vt.

Insects and butterflies from China; state what is offered in exchange. Edward Laurent, 621 Marshall St., Philadelphia, Pa,

I have a four-legged and four-winged one-headed chicken, in alcohol, which I should like to exchange for a good breech-loading shot gun, or for standard scientific books. A. H., Box 500, Albion, Ohio.

Good Specimens of the 17 years' locust (17 year cicada), in exchange for any kind of insects, beetles, moths, or butterflies. Harry C. Beardslee, Painesville, Lake Co., Ohio.

Wanted, scientific books, minerals, fossils, and Indian relics, in exchange for minerals, fossils, coins, old Continental and Federal money over one hundred years old (very rare), foreign stamps, A. W. Baily, Box 712, Atlantic City, N. J.

Birds eggs, books, foreign stamps, a good hammock, and revolver, to exchange for birds eggs and works on birds. F. D. Brown, Gallupville, Schoharie Co., N. Y.

A magic lantern with eight slides, cost $5, and other things, to exchange for scientific books, chemicals, or chemical apparatus, etc. A Campbell, Box 31, Derrick City, McKean Co., Pa.

Idaho Mineral Specimens, for bound books on science, travels, history, biography, political, masonic, and others that are instructive. J. P. Clough, Junction, Lemhi Co., Idaho.

I have minerals (including fossils and dentrites), to exchange for minerals; also a papyrograph outfit, without press (worth $25), for offers. W. H. Eastman, Hyde Park, Mass.

Craig's Simple microscope and three objects, $2.50; 155 rare stamps in small album, 1 font of type; "Illustrious Mechanics," $1; "Northern Lights," $1.50; for coins and curiosities. Geo. K. Fischer, 729 North 6th St., Phila.

Klose's celebrated "School for the Clarionet," new, $3; will enchange for telescope, microscope, piccolo, books, or offers. Rush Holbrook, Wonewoe, Juneau Co., Wis.

One or two handsomely mounted red deer heads, attractive ornaments for any dining-room or hall, for microscope, telescope, sporting implements, camping outfit, scientific books, or offers. R. B. Hough, Lowville, Lewis Co., N. Y.

A new E-flat solo cornet, cost $22, for a self-inking printing press and outfit of same value and condition, also B-flat clarionet, books, papers, magazines, etc., for offers. C. W. Hughes, P. O. Box 96, Shreve, Ohio.

Hope's Manual of Sorento and Inlaid Work, cloth edition, price $1.25; would like to exchange for books on aquaria postage stamps, hammocks, or almost anything. G. Keppel, Zeeland, Ottawa Co., Mich.

A new one horse power horizontal steam engine, in complete running order, worth $60, for a first class coal stove, watch, or offers. Geo. L. Lamson, La Fargeville, Jeff. Co., N. Y.

A handsome Young America self-inking printing press, chase 3½ x 4¾ inch with 5 founts of type, 300 cards, and outfit complete, for a good wood-turning lathe, or offers. E. McLean, 443 Clermont Ave., Brooklyn.

Telescope, microscope, drawing instruments, and other things, in exchange for printing press and outfit, or offers; wanted, cards, type, etc. Ewing McLean, Greencastle, Ind.

I should like to exchange birds eggs with any one living in the far West, South, or in foreign countries. Wallace Ross, Lock Box 97, Rutland, Vermont.

I have some good specimens of Pentremites from the sub-carboniferous formation, that I would like to exchange for books, H. Russell, Grassy Cove, Cumberland Co., Tennessee.

Bonanza printing press, with three fonts of type, and assortment of blank cards; value of outfit $7.25; would like rifle, books, or offers, Geo. R. Simpson, Janesville, Bremer Co., Iowa.

Fine cabinet for sale or exchange; polished walnut and maple, 27 drawers, 3 closets, all locked; 7 ft. x 5 ft. x 19 inches; for any kind of specimens. W. W. Stockton, Box 190, West Chester, Chester Co., Pa.

The Young Scientist

SCIENCE IS KNOWLEDGE. KNOWLEDGE IS POWER.

INDUSTRIAL PUBLICATI

A PRACTICAL JOURNAL OF

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VOL. III. NEW YORK, NOVEMBER, 1880. No. 11.

Collodio-Etching.

BY BENJAMIN HARTLEY.

WE may not be able to find anything altogether new in this age of progress, but we do see everywhere the revival and improvement of many old things. Ancient methods and materials are being rediscovered in every branch of science, art and mechanics.

In the midst of these revivals we find copper-plate etching taking quite a prominent place; and more than one magazine is devoting itself to the advancement of this old branch of art. Four hundred years ago etching was studied and used by the best painters, but during the last century and early part of the present one, this art, as distinct from engraving, was almost unkown. In fact it is only within the past twenty years that it has revived as an independent study.

At the present time we find, both in Europe and America, the *Etching Club* in place of the Sketching Club.

To *etch*, means to bite or eat, from the Dutch word *etsen;* so that those lines only that are eaten away or bitten out by acid from the plate are etched.

Many suppose that etching on copper is an easy matter, because the picture is drawn with a needle instead of being cut with a burin; while truly, as Mr. Hammerton says, it is exceedingly difficult. This difficulty arises from two causes; first, the etcher does not see his work properly as he proceeds; and second, mistakes or misfortunes in the biting, which are of frequent occurrence to the inexperienced, may destroy all the relations of tone. Besides, it is an expensive pleasure. Plates and press cost more than most of the readers of the YOUNG SCIENTIST would care to invest; so I wish to lay before them a process by which they can more easily, and with less expense, duplicate their sketches than by copper-plate work. It is not etching, properly so called, but simply drawing with

a needle on a prepared glass plate, which is afterwards printed like a photographic negative. It was suggested and tried more than ten years ago, but was laid aside for various reasons which I will not stop now to explain.

Those who have the first volume of the YOUNG SCIENTIST will find in its lessons on photography all the apparatus and materials named which are necessary for preparing the plate. It is done just as a photographer goes about making a negative. The glass is first thoroughly cleaned and flowed with collodion, then it is sensitized, or coated, in a bath of nitrate of silver. This can be done in a shallow porcelain or glass tray with a silvered wire hook to lower and raise the plate, as seen in Fig. 1.

Should the reader not care to prepare his own plates, he can get them from a photographer for from ten to twenty-five cents each.

Cabinet size I find the most convenient for small studies. This will make a picture 4 by 6 inches.

For the first attempts the plates should also be varnished with a good thin negative varnish, as the film is so delicate that the slightest touch will make an impression. The sketch has now to be transferred to the plate, and in order to have it, when printed, the same as the original, it must be reversed. If the drawing is just the right size, and made with a soft pencil, it can simply be turned over on the varnish, and the back of it rubbed lightly with the finger, (the varnish being dry)

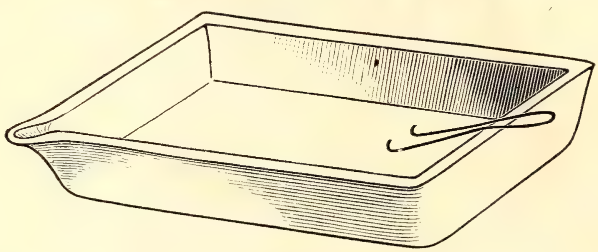


Fig. 1.

The only hint necessary about this part of the process is to be sure and lower the plate regularly, without stopping, into the solution. The advantage of the tray over the standing bath, is that you require but a small amount of silver solution to cover the plate. Sensitizing is done in a dark room.

Now, if you have a camera, you can point it at a perfectly white screen and expose the plate for about twenty seconds, and then flow over it a solution of protosulphate of iron. (See Vol. 1, page 118). The iron will make the film opaque, and of a grey color. Wash well and dry, and the plate is ready for the picture.

If you do not possess a camera, (it is not necessary) you can just open the door of your dark room, and let a strong white light fall directly upon the plate a couple of seconds, and then develop, with weak developer, as before stated.

when the outline will be seen on the plate as the paper is raised. This, however, can only be done on varnished plates, of course. Another method will be treated of hereafter.

The next thing of importance, is a stand something like a photographer's retouching frame. This is to rest the plate on while drawing with the needle, because by this process you can see the picture distinctly as it progresses. I will tell you how I made one. I took the frame of a broken slate and screwed strips of wood to the sides for legs, thus making it to stand like a square easel. Then I took two pieces of wood half an inch wide and a quarter of an inch thick, and just as long as the inside of the frame; to each piece I fastened a thin strip to the narrow side as long as the outside measurement of the the frame, and with screw eyes near the ends attached them to the frame

behind, thus letting the former pieces project in front for the plate; as seen in the accompanying illustration (Fig. 2.)

Placing a sheet of white paper on the table behind the frame, light will be reflected against the under side of the plate, and every dot and line will be distinctly seen as made.

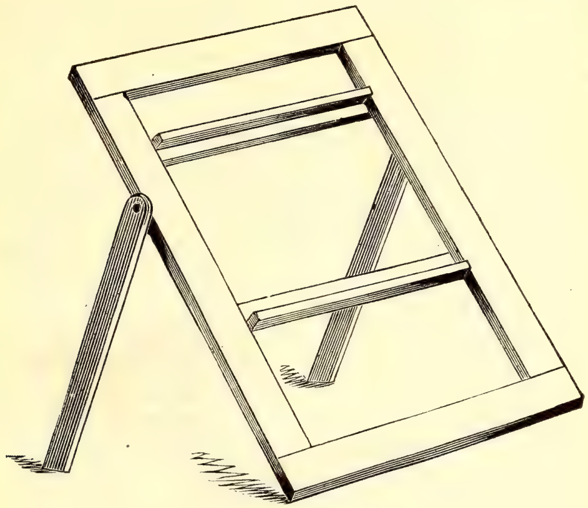


Fig. 2.

Another thing requisite is a good magnifying glass. I use two glasses arranged like a pair of spectacles, on a stand, and held by it in position over the plate.

We now come to the needles to be used in drawing. Take three needles of different sizes, fine, medium, and coarse, and tie them to pieces of wood like the handles of camel's hair brushes. Let the point of the needle project from the end of the stick only a quarter of an inch. This keeps the end firm. A darning needle being used for the largest size, you must file the point until it presents, under the magnifying glass, the long lozenge shape of a graver.

And now, if you have studied the drawing lessons given in the second volume of the Young Scientist, or have some independent knowledge of art, you will be able to go to work on the picture.

Put the plate on the frame. Take the finest needle and go over the entire outline. Let the subject be a simple one to begin with. Then, with fine lines, put in the shading of the distance; the middle distance, with the medium needle, may be a little bolder; while the foreground lines make broad and coarse. The plate, held up to the window, will be a transparency of your picture with light and shade reversed, and will show any defects. Other details I will have to leave for another paper.

Ornamental Turning.

(*Continued from page* 110.)

ONE thing we feel bound to advise, and that is, not to have a large case of tools, as made by some of the best makers, but a few well-assorted tools in long and short handles, according to their nature. This, of course, applies to hand-tools. Having practiced and made many things with such tools as are already possessed, it may be the desire to make an addition to the stock of apparatus. In this case an oval chuck will be the most useful, because we have facilities for a deal of eccentric work with the cutter. The oval chuck is a beautiful tool to work; its action being obtained by two steel pallets working round a ring—that is, fixed to the mandrel-head; in order to obtain the dif-

ferent degrees of ellipticity, this ring is moved from a given point. To work this chuck a slow motion must in all cases be used, in order to stay the vibration that is otherwise caused by the oscillation of the slide of the chuck. To determine the difference between the major and minor axis of the ellipse is a simple matter. For instance, if the ring is moved ¼ in. from the centre, the difference will be just ½ in. This gives an example, and it must be clearly seen the ellipse is exactly twice the size one way to what it is the other. Many beautiful patterns may be executed with this chuck, by dividing with the wheel that is on the front of it. In dividing with this instrument it must be obvious to all that the division must take place on the wheel, as the mandrel must necessarily revolve with the action of the chuck. A few practical lessons or hints on this tool will soon enable a complete novice to overcome its difficulties. When the use of this chuck, to a certain extent, is mastered, and another addition is required, we should recommend as the best an eccentric chuck, because the combination of the oval and eccentric produce some very beautiful work. The latter, when used with the former, should be fitted with a transfer chuck; it will then run true on its place. In continuing to give an account of the various additions to be made to an ornamental turning lathe, we do not wish our readers to labor under the impression that all the various things we name are absolute necessaries, but, from a long experience, we feel enabled to advise the best means of proceeding, if it be the wish to do so; though, before making any further purchases, be certain that you know the use of that which you already have. The dome chuck will be found the next most useful addition, as some very pretty work can be done with it, and to a very limited extent it takes the place of the spherical slide-rest. This chuck may be worked in conjunction with the oval and eccentric, and most curious results obtained. One of its principal uses will be to cut square or hexagon bases; with the slide-rest set to the surface, this kind of work may be done in various ways. Some prefer one, some another.

In proceeding with additions to the lathe, a drill-spindle, with a set of large moulding-drills, will be found a very useful thing to have; this also enables the turner to produce some very elaborate work with very little trouble. Passing again to chucks; the geometric chuck is one that to some turners gives a deal of satisfaction, and it certainly is a most beautiful tool; but, at the same time, it does little more than what the chuck does, leaving little scope for the the operator's powers of design. We prefer to see some of the beautiful tazzas, vases, etc., that are done by some of our readers, who excel in the use of the more simple chucks and cutters. When we come to all these expensive additions, naturally a large expenditure is necessary, but it is not at all necessary to spend a large sum to produce some fine work.

Science in Common-place Things.

IT is an old proverb that a man cannot raise himself by pulling on the straps of his boots. Something almost as wonderful can be done however: A man can easily raise himself by the pressure of his own breath, and if time were given him, it would not be impossible for a man to raise himself to the top of a house by this means. *How* it may be done we may explain in a future number, but in the meantime we will tell our readers how to perform an experiment almost as wonderful, and that is, to blow an egg out of one wine glass into another. Now an egg is a tolerably solid affair, weighing on the average about two ounces. If we were to attempt to blow it about, or support it in the current of air propelled from the mouth, we would probably fail, but if we proceed as follows, success is almost certain after a few trials.

Get an egg, and lest it should fall and make a mess, it is well to have it hard boiled. Then select two wine glasses in which the egg will nicely fit, (or if you have the glasses you may select the egg—either way will do), and place the two wine glasses as shown in the figure, but rather closer together, as it will be found difficult to send the egg as far as the dis-

tance there shown would indicate. A sharp puff of breath applied as shown in the engraving, will cause the egg to leap from one glass to the other.

The rationale of this striking experiment is very simple. An egg presents considerable surface, and the glass serves to concentrate and confine the force of the current of air to this surface. We have, therefore, a strong current passing down the very narrow space between the glass and the egg, and then exerting its force on a broad surface to raise the egg.

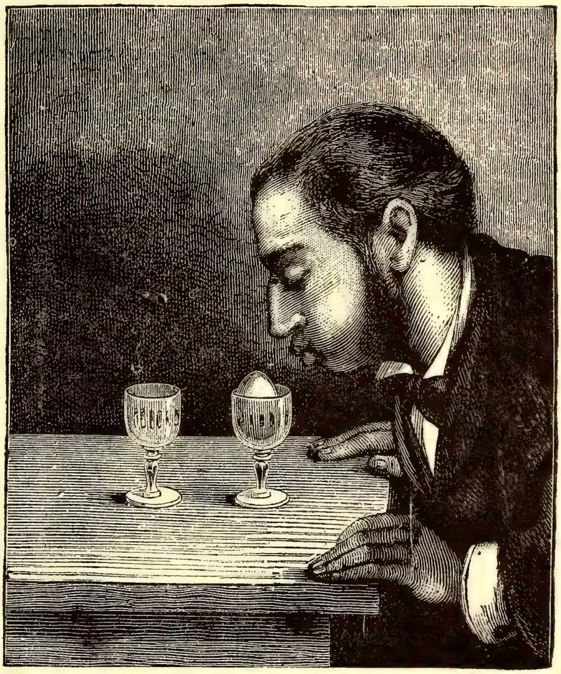
It is evident that we must send the current *between* the glass and the egg; it will not do to blow directly *on* the egg. The action is then something like that of the hydraulic press, and the experiment never fails after the operator has had a little practice. This was one of Faraday's favorite lecture experiments, and we ourselves have often performed it to the astonishment of large audiences.

Home-made Telescopes and Microscopes.—XI.

NEW FORMULA FOR A MICROSCOPE OBJECT-GLASS BY MR. WENHAM. (*Continued*).

At the commencement of the year 1873, the author caused a few object-glasses to be made, with a middle of the form of Fig. 18, the performance of which was very satisfactory. In this the extreme rays pass at more favorable incidences, and within the angle of total reflection. The upper lens is of dense flint.

When the experiments on the single front were concluded, and the remarkable corrective power of the triple back in conjunction therewith had been proved, the next attempt was to make the middle also a single lens, leaving the entire color correction to be performed by the one bi-concave flint in the back. After numerous trials it was found that though something like over-correction or negative aberration could be obtained with the back,



LIFTING AN EGG BY THE BREATH.

in the degree requisite for balancing the under-correction of the single middle and front when set at the prescribed distance of the aplanatic focus, yet by trial on the mercury globule all the results invariably displayed two separated color-rings; these could not be combined by alteration in the radius of the lenses. By projecting the blue or red, or visible rays of greatest and least refrangibility through the system, the cause became apparent. The left hand section of this object-glass is shown in Fig. 19. The rays from the focus are slightly divided by the first front surface. On emerging from the back the separation is increased; the red ray (*r*) is outwards, and the more refrangible or blue ray (*b*) inwards. Next the divergence of these two rays is extended by the middle single lens. The following crown lens extends the angle of divergence so far that the flint lens of the back triple cannot recombine them; and they emerge at two distinct zones, shown by the practical test of the "artificial star" or light-spot reflected from a mercury globule, viewed within and without the focus.

It might be supposed that these rays at their final emergence can be so refracted as to project the blue outwards. A cross-point would then occur at a fixed conjugate focus in the body of the microscope, at which all rays would be combined, and if this focus was adjusted to that of the eye-piece, achromatism and final correction would be the result. But to meet the various conditions occuring in the use of the microscope, the conjugate focus constantly alters in position, this being affected by every change of eye-piece, length of tube, or adjustment for thickness of cover; therefore a correction for a fixed point cannot be maintained. Achromatism in the microscope object-glass, like that of other perfectly corrected optical combinations, must be the re-union of the rays of the spectrum close to the final emergent surface of the system. The remedy suggested by these experiments appeared to be in a transposition, that is, in placing the over-corrected triple in the middle of the entire object-glass; this would at once cause a convergence of the blue and red rays. A single lens of longer focus at the back would then bring these rays parallel at the point of final emergence.

By projection in a diagram, this condition was apparently realized. The dispersive power of the flint (density 3·686) was taken by the refractive index 1·76 of line H in the blue ray of the spectrum, and 1·70 of the line B in the red ray. The refraction of the corresponding rays in the crown (density 2·44) was 1·53 H and 1·51 B. With these indices the rays are traced in Fig. 19. The radii in the right-hand half section are these of an "eighth" of the new form drawn about 15 times the size of the original. The single front is of the usual form, as this is much alike in all cases. The radius or focus of the single plano-convex back is about four and a half times that of the front, and the focus of the middle (triple) three times. The passage of the blue and red rays at the extreme of the pencil is shown in contrast with the preceding, the separation from the same front being alike.

The inner and outer, or blue and red rays, after passing the first surface of the triple middle, meet the concaves of the flint, which refract the blue rays to a greater extent than the red, and cause them to converge (instead of diverging, as in the opposing half diagram) so that at their exit from the triple they meet and would cross, effecting what is known as "over-correction;" but this is so balanced and readjusted by the single back of crown-glass that the rays are finally united, and emerge in a state of parallelism. This form of object-glass is suitable for the high powers, or such as have a cover adjustment, viz., from the "½-inch" upwards; perfect color-correction is equally to be obtained in all of them.

It may be asked by some who have devoted their attention to the higher branches of optical mathematics, why the above result should have been worked out entirely by diagrams. But it has been found such a difficult task to calculate the passage of the two rays of greatest and least refrangibility through a combination having sixteen surfaces of glass of three different densities and refractions,

that even first-class mathematicians have hitherto shrunk from the attempt.

Diagrams, however, are surprisingly accurate in their capability of indicating causes and results in the microscope and object-glass; for these lenses are minute, with deep curves and abrupt refractions; so that if the projection is worked out

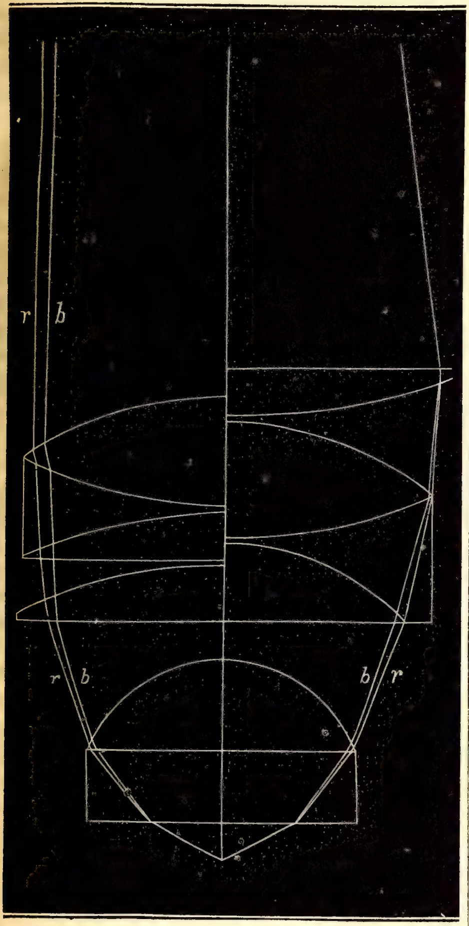


Fig. 19.

some fifty times the size of the original, small errors can be detected. The work should be commenced at the back from a long conjugate focus, which not being a constant distance, may be taken as very near to parallelism. The high powers all have the means of correction within this distance, and perform better with a long posterior focus than with a very short one. The relative indices for the two or more rays should be marked on a large pair of proportional compasses, the long limb representing the sine of the angle of incidence, and the short one that of refraction. Both the sines ought to be set off in a diagram behind, and neither of them in front of the ray in couse of projection; this leaves the way clear, with the least confusion of lines.

At the same time a second or counterpart diagram should be at hand, to which the rays only are transferred as soon as their direction is ascertained; with these precautions a mistake is scarcely possible.

Now it is hoped that some improvements may be effected by this investigation, on account of the simplicity attained in the combination, in which we have two single lenses of crown, whose foci bear a definite proportion to each other; while all the corrections are performed by one concave of dense flint, the acting condition of which is not altered by the influence of any other concaves acting in the combination, and hitherto taking a share of the duty. This one flint is now to be considered singly as the heart and centre of the system in reference to the correction of the rays entering and leaving.

This memoir is of necessity incomplete. for want of definite information concerning the optical properties of various kinds of glass. Nothing of importance has been published since Fraunhofer's Table containing the refractive indices for each of the seven primary color-lines of the spectrum for ten kinds of glass. Great advance has been effected since that date in the manufacture of optical glass, a most complete collection of which, of every variety, has been made by the Messrs. Ross, up to the present date. Selected specimens from this will be worked into prisms, and the relative spectra mapped out by the Fraunhofer lines, leading, it is hoped, to the discovery of a combination of crown and flint glass which shall be free from secondary spectrum or absolutely achromatic ("Proc. Royal Soc.," No. 141, 1873).

Three Amateur Workers—and What They Did—III.

BY FRED. T. HODGSON.

THE next day being Friday, Jessie and the boys had some little messages to perform for their mother. They were soon relieved, however, and immediately repaired to the shop, where they found their father waiting for them.

"Now, Pa," said Fred, "please show us how to complete the work-bench."

"Well," said Mr. Carpenter, "we must nail two of the cross pieces on to the legs, minding to keep them even with the tops. See, also, Fred, that the cross pieces are even at their ends with the sides or edges of the legs."

"Now then," said Mr. Carpenter, after Fred had nailed the cross pieces well on to the legs, "we must get two pieces of inch boards, twelve or fourteen inches wide, and twelve feet long, for side pieces." Fred and Ellwood soon found the pieces required. With the aid of their father they nailed these pieces on the legs, keeping the latter about one foot from the ends of the side pieces, and even with its top edge. They also took care to have the legs placed at right angles with the top edges of the side pieces.

Three cross pieces yet remained to be put in the bench between the two legs as now placed. This was an easy matter, as one was placed in the centre, and the other two midway between the legs and the centre one. These three cross pieces were kept in their places by being nailed fast to the side pieces. The bench was now ready for the top, which was formed of three pieces of plank, one and a half inches thick, and nearly thirteen inches wide, and twelve feet long. These were well nailed on, and the nail heads were driven deep into the wood by a small steel punch, called a "nail-set." This process of sinking the heads of the nails in the wood, is to keep them out of the way of the plane irons, chisels, gouges, and other edge tools that will be used on the bench. The bench now looked like a large table three feet two inches wide by twelve feet long. Mr. Carpenter cut the ends of the side pieces beveling, and bored about twenty holes in them, for a movable peg of wood, to be inserted when the edge of long stuff is to be operated on. A bench

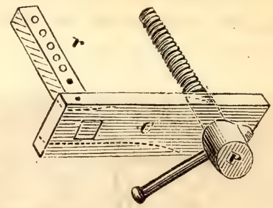


Fig. 6.

screw that Mr. Carpenter had provided, at a cost of seventy-five cents, was next produced and fitted in a jaw-piece, on the lower end of which was a slide-piece to keep the jaw parallel when in use.* The slide-piece was perforated with half-inch holes, in which a loose iron pin is intended to be put when in use, to hold the jaw parallel with the leg of the bench.

A round hole, large enough to allow the screw to pass through, was then made in the leg and side of the bench; a mortise was also put through the leg near its bottom end, great care being taken that the two holes were the proper distance apart, and that the round hole was bored at the proper distance, so that the top of the bench and top of jaw would correspond.

All being now ready, Mr. Carpenter put the jaw and screw in place, and Ellwood took the nut and held it on the inside of the bench leg, while his father inserted the screw and wound it up until the jaw was good and tight against the side of the bench. This brought the nut also tight against the inside of the leg and in proper place. It was fastened there with two long screws and a few nails.

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*Fig. 6 shows how the screw and jaw were fitted together before being put in the bench, *P* is the screw, the arm of which goes loosely through the jaw, *C*. There is a groove turned in the neck of the screw, and a piece of hard wood with the end cut to lap round the neck in the groove, and of the exact thickness that the groove is wide, is driven through a mortise in the edge of the jaw, down in this groove. This holds the jaw and screw together, and, as the wooden nut is fastened on to the inside of the bench leg, it permits the jaw to move to and fro whenever the screw is turned in or out; *r* shows how the slide is fastened into the jaw, and the holes for the iron pin.

The work-bench* was now completed with the exception of a "stopper" in front, on the top. This was soon got over, however, for a mortise one and a half inches square was put through the top plank, just alongside of the front

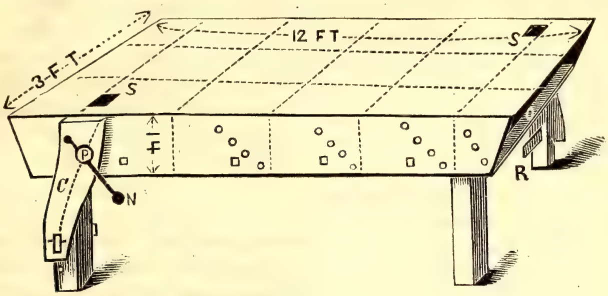

Fig. 7.

cross-piece, and a piece of dry hard wood, $1\frac{1}{2}$x$1\frac{1}{2}$ inches, and six inches long, was driven into the mortise, with the top end left above the surface just a little mite. It is so arranged that it can be driven down or up, at will. The opposite side of the bench was also furnished with a screw and "stopper," and holes were bored in the side so as to receive a peg, same as the side described. Mr. Carpenter thought it would be as well to finish both sides of the bench alike, so that the two boys, or himself and one boy, could work on it together.

The bench was now placed in position on the floor, and as there was a window opposite to each end, it was arranged so as to suit the light.

"Now, Ellwood," said Mr. Carpenter, "bring the planes from the house, and put them on the bench."

The planes were forthcoming at once, and consisted of a smoothing plane, a jack plane, a fore plane, and a jointer. The bodies of these planes were made of good dry beech wood, for Mr. Carpenter wisely thought it would be better to provide the boys with wooden than iron planes, as the former would stand more rough usage without becoming useless, than the iron ones.* He told the boys the

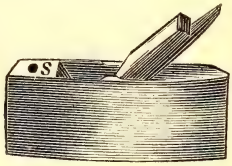

Fig. 8.

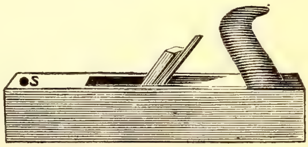

Fig. 9.

planes had better not be used until they had been well oiled all over with raw linseed oil, two or three times, and to

*Fig. 7 shows the work-bench when finished. *C* is the jaw; *P*, the screw; *N*, the lever by which the screw is operated; *R* shows the slide; *S* the stopper. The dotted lines running across the top of the bench and down the side, show the positions of cross pieces. The side pieces are well nailed on to these cross pieces. The dotted lines running lengthwise show the joints of the planking that form the top. This planking is well nailed on to the cross pieces. On each end of the bench a board is "cut" in between the side pieces and nailed; these form shelves, as shown at *O*, and are very convenient for planes, squares, or other tools. The bench should stand firm on the floor, and should be solid and "out of wind," or not twisted on the top.

*Fig. 8 shows the smoothing plane. It should be from 7 to 9 inches long, and have an iron from 2 to 2⅜ inches wide.

Fig. 9 is the jack plane. This should be from 16 to 18 inches long, and should have an iron from 2 to 2¼ inches wide.

Fig. 10 shows the fore plane, which is from 20 to 22 inches in length, with an iron from 2¼ to 2½ inches wide.

Fig. 11 shows the long jointer. This plane is made from 24 to 30 inches in length, and is only intended to be used for the most exact work. It requires more care than any of the bench planes, owing to its great length. To do good work, it requires to be perfectly straight and out of wind, and when not in use it should be put in a dry flat place, face downwards. *S* shows the "starter" on each plane. It is formed of metal or hard wood, and is let into the plane about half an inch.

have it well rubbed in on the ends. He explained to them that the oil would prevent the planes from checking, and render them less liable to be affected by dampness, and makes them somewhat heavier, which is an advantage to the two larger planes.

Mr. Carpenter also showed the boys how to draw the "irons" out of the planes by "tapping" the "starter" gently with a hammer or mallet; he also described the uses of the different planes, stating that the jack plane was used for taking off the rough surface of lumber, or cutting down irregularities. He showed them that the iron should be ground a little rounding, to enable it to work well on rough stuff. The fore plane, or "try-plane," as some workmen call it, he said, was for the purpose of making the surface even and fair after the jack plane had taken off the rough. "I will show you," he said, "how to use this and the other planes properly, when we get fairly to work, and in the meantime I will just say that the smoothing plane is used for smoothing off joints of frame-work when put together; for fitting work, squaring up end-wood, and smoothing work in general. It should be kept very sharp, and set very fine, and if in good order will make shavings like ribbons of silk. The jointer is used for jointing all kinds of stuff straight and square. It is indispensible in making glue joints, or doing any work where long straight edges are required.

(To be continued.)

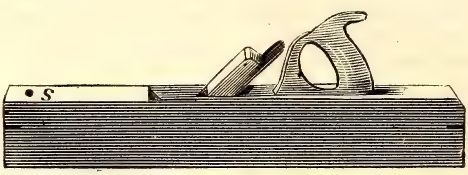

Fig. 10

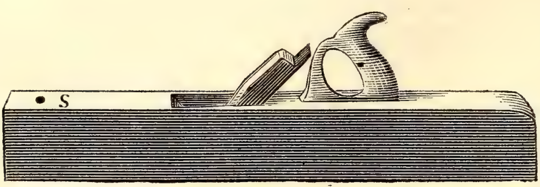

Fig. 11.

Water-Proofing with Paraffine.

SOME time ago, a method was devised for employing paraffine as a means of rendering leather water-proof, also the various textile and felted fabrics, and, subsequently, improvements have been made on this process, which consisted chiefly in combining the paraffine with various proportions of drying oil, it having been found that paraffine alone, especially when applied to fabrics, became to a considerable extent detached from the fibre of the cloth after a short time, owing to its great tendency to crystallize. The presence, however, of even a small quantity of drying oil causes the paraffine to adhere much more firmly to the texture of the cloth, sufficiently so, it is found, for all ordinary purposes, from the oil gradually becoming converted into a tenacious resin by absorption of oxygen.

In the application of this substance for water-proofing, it is first melted together with the requisite quantity of drying oil, and cast into blocks, and the composition can then be applied to fabrics by rubbing them over with a block of it either cold or

gently warmed, or the mixture may be melted and laid on with a brush, the complete impregnation being effected by subsequently passing it between hot rollers. When this mixture is applied to cloth such as that employed for tents, it renders it very repellant to water.

A very advantageous application of the paraffine mixture is made to various kinds of leather, one of the most convenient ways of accomplishing this being to coat the skins or manufactured articles—such as boots, shoes, harness, etc.—with the melted composition, and then to gently heat the articles until it is entirely absorbed. Thus impregnated, leather is not only rendered perfectly water-proof, but stronger and more durable.

How to Turn Boxes.

FIRST, then, as to the material to use; this is to a certain extent a matter of taste, but for the uninitiated to begin or practice upon, there is nothing like boxwood. It is both pleasant to work, and comparatively inexpensive; this, as a quantity is likely to be consumed, is an important matter. We will take a piece, say 3½ to 4 inches in diameter, about 4 inches long, and in order to rough it down, first, make the two centres, and indent one end to receive the prong-chuck, place it in the prong and bring to bear the poppit-centre, then take a cup chuck and fit the end of the wood into it about ½ inch deep, slightly taper and drive it in as lightly as possible. The most effective way of driving it in without damaging the face of the chuck is to simply place the wood in the chuck, hold it (the wood) in the hand and strike the end of the wood; this will cause it to become quite tight; if the face of the chuck is placed on the bench, it is likely to become bruised or marked, and so cause it to run out of truth, but a little experience will soon teach all these points better than all the writing. So far, then we have the wood chucked ready to begin operations. The first part to make is the lid, or top of the box. This must be carefully turned out the desired depth, and for a beginner, it will be less difficult to fit if made slightly taper, but it is better, when a little further advanced, to make the fitting perfectly cylindrical. When this is turned out, and the face of the inside finished, which must be done at the same time, to save the trouble of rechucking it, the top must be cut off with a parting tool, and then it can be fitted to the bottom; and when this is done, it forms a chuck for the purpose of turning it. This will save all further trouble, and the box may be finished, as it were, all in one. If it is to be ornamented, that must be done without removing the top. The inside of the bottom must not be taken out till the last thing. Now, it may happen that having finished a box of this description, and made a very good fit of the top and bottom, in fact, quite satisfactory in all ways, that upon a re-examination at another period, say the next morning, it will be found that it does not fit at all. This is caused by the wood shrinking, sometimes it will expand, and hold the lid so tight that it will be difficult to remove it. When this is the case, of course it is an easy matter to make it easy. Not so however, when it is already too easy, but these are difficulties that all turners have to contend with. The best way to get over this difficulty is to screw the top and bottom together, instead of making them plain-fitting. This is a more difficult process, and will require a deal of practice, especially if the turner has not a traversing mandrel to his lathe; it is at the same time to be overcome with practice, first having had some practical information on that particular point. Now it will not do for a novice, when he has made a very fair job of his first box in wood, to go directly to ivory, for it is an expensive material; moreover, the second attempt may not prove so successful as the first, and if this is the case a great disappointment and loss may occur.—*Forge and Lathe.*

Corn Starch Paste.—Corn starch makes a good paste for scrap-books. Dissolve a small quantity in cold water, then cook it thoroughly. Be careful and not get it too thick. When cold it should be thin enough to apply with a brush. It is not so liable to mold and stain the paper as paste made from other kinds of starch.

To See Objects Apparently through the Hand.

THE following curious experiment throws a good deal of light upon the facts connected with vision.

Take a sheet of ordinary letter paper, roll it into a tube, and through it look at some distant object with the left eye, the right eye being also open. If the hand be now held before the right eye, so as to cut off the view of the object by that eye, the object will still remain visible to the left eye. Strange to say, however, it will *appear* to be visible to *both* eyes, and a hole, the exact size and shape of the tube, will appear through the hand as shown

LOOKING THROUGH A HOLE IN THE HAND.

by dotted lines in the engraving! In other words, it will appear to us as if there was actually a hole through the hand, the objects being seen through that hole.

This singular optical illusion is evidently due to the sympathy which exists between the two eyes from our habit of blending the images formed in both eyes, so as to form a single image. The result is startlingly realistic, and forms one of the simplest and most interesting experiments that we know of.

Editorial Notes.

Mr. Wenham's Paper on Object-Glasses.

THOSE who read these papers will see at once that *some* of them are intended for any but "young" scientists. Indeed, it will require a very intelligent student to follow the one in the present issue, and we would have omitted this, as unsuited to our columns, if it had not been that to do so would have left the series incomplete. We have thought it best to give Mr. Wenham's papers entire; a large portion of them are so plainly written that any intelligent boy can understand them, and the rest is of value to such a number of our subscribers that the space can not be considered wasted.

BOOK NOTICES.

The Students' Illustrated Guide to Practical Draughting. A Series of Practical Instructions for Machinists, Mechanics, Apprentices, and Students at Engineering Establishments and Technical Institutes. By T. P. Pemberton, Draughtsman and Mechanical Engineer. Illustrated with Numerous Engravings. Price $1.00. New York: Industrial Publication Co.

This is a simple and thorough book by a draughtsman of twenty-five years experience. It is intended for beginners and self-taught students, as well as for those who pursue the study under the direction of a teacher, and having been written by one who has had a large experience in teaching, the wants of both classes have been very fully met. So far as regards the mere art of drawing, the advanced student will probably find little in this book that will assist him, but the chapters relating to gearing and screws, aim to give thorough and practical knowledge, not only as to the best methods of delineating them, but as to the true principles involved in their construction. In these departments the author has been assisted by the well-known mechanicians, Joshua Rose and John Walker, whose names are a sufficient guarantee of the excellence of the methods explained.

Levers of Archimedes, with the Fulcrum Found. By Will Powers. Philadelphia: G. W. Townsend.

These "levers" consist of a certain system of examining and studying any subject that may be proposed. The points to which special attention is to be directed are the cause, the essentials, the associations, etc., of the subject to be studied, and the so-called "levers" are printed blanks in which this scheme is fully laid out.

The idea is a good one; whether the "levers" will enable the student to carry it out or not is

another thing. One thing is certain, however, that the mere effort to do so must have a good effect.

Correspondence.

A Foot-Power Scroll Saw and How to Make It.

[The following letter will prove interesting, not only from the clear and excellent way in which our young subscribers are told how to make a cheap but very good scroll saw, but as showing the influence of our journal in teaching boys to work out these things for themselves. H. has succeeded admirably, and we hope that others who have good things that they have worked out themselves will send them to us.—Ed. Young Scientist.]

Some articles about scroll-saws have already been given in the Young Scientist. Perhaps another one would not be amiss, especially as it treats of a foot-power saw. This saw is thoroughly original, and leaves much room for improvements; therefore, any boy trying to make it will surely make some improvements to suit himself.

Take two strips of ash or other elastic wood, about 18¾ inches long, and ¾ inch wide. These strips are to act like springs; they also form the arms of the saw. The upper spring must be the strongest, and ¾ inch thick at one end, diminishing gradually to ¼ inch. The lower spring varies from ¼ to ⅛ inch. At the thinnest end of each spring, glue a small square of the same wood, and place the grain crosswise to that of the spring. This is to insure solidity, because a hole must be bored through the spring and small square to put the clamp in, as shown in Fig. 1.

Now find a nice smooth piece of board, not less than ½ inch thick, 8¾ inches wide, 38 inches long. This is to form the table of the saw. Make one end of the board round. Take two pieces of strong wood 1 inch thick, 1½ inches wide, and

Fig. 1.

4½ inches long. At each end of these, cut out a piece in which you insert the arms of the saw. Try to have as perfect a fit as possible, and make the upper arm slope a little downwards. This done, take your board, and, eight inches from the square end, cut a hole in which you tightly fit your two uprights, leaving them 1¼ inches apart, and 3½ inches from top of table, as shown in Fig. 2.

You can now take the arms of your saw and screw the thick ends firmly into these uprights. The thicker arm is for the top. Bore a hole in the board, on a straight line with the clamps, to allow the saw to pass through. The board, with the mounted saw-frame, can be screwed on a common table. You must screw the square end on the table, leaving the rest of the board outside.

On the lower arm of the saw adjust a brass strip, ⅜ of an inch wide, and make the two ends meet underneath. You now bore a hole through the two ends, through which a piece of stout wire is inserted. Your wire connects to a treadle. Leave the wire short enough to allow full play to the treadle. It is well to make one end of the treadle stationary.

Boys, your saw is finished. If you could mount it upon a real table instead of a board, you would have a much stronger hold and more power. I have done very fair work with mine. If any of you succeed and make improvements, write to the editor of the Young Scientist, and ask him to insert them in the paper. I have made a blow-pipe, which is half a putty-blower, run through an upright stick, and screwed on the end of the board in front of the work. H.

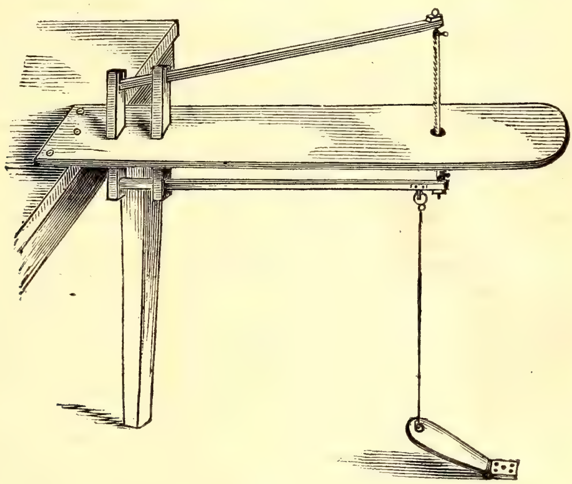

Fig 2.

Astronomy for Amateurs.

BY BERLIN H. WRIGHT.

THE PLANETS—DECEMBER, 1880.

(Calculated for the Latitude of New York City.)

	D.	H.	M.	
Mercury rises	13	5	33	morning
" "	16	5	41	"
" "	19	5	51	"

This will be a favorable time to look for this planet. On the 16th he rises 2h. 37m. before the Sun, and exactly at the time of beginning of the morning twilight. He should be looked for at the time of rising 26° south of the east point, and 5½° (a little more than the distance between the "Pointers") north of the Sun-rise point. He is in the constellation Scorpio, and about the time of sunrise may be confounded with the bright red star Antares, and though they will appear much the same in color, Mercury is the brighter, while Antares is nearly 7° further *north*, and does not rise until 6h. 20m. morn.

	D.	H.	M.	
Venus sets	10	7	10	evening
" "	20	7	34	"
" "	30	7	58	"

Venus is a beautiful evening star, and will increase in brilliancy during the remainder of '80, and until March 27, '81.

	D.	H.	M.	
Mars rises	10	6	10	morning
" "	20	6	7	"
" "	30	6	2	"

This planet may be mistaken for Mercury, which rises but a few minutes earlier. A comparison of their respective places on the 16th shows that Mars is 17m. 4¼° east, and 2½° south of Mercury, and inferior to him in brilliancy.

	D.	H.	M.	
Jupiter in meridian	10	7	17	evening
" "	20	6	40	"
" "	30	6	3	"

SATELLITES OF JUPITER.

The following are some of the principal and most interesting events which transpire in the Jovian system in the evenings of December.

				D.	H.	M.	
Sat.	I.,	Tr.	In.,	1	8	53	evening
"	II.,	Oc.	Dis.	1	10	57	"
"	I.,	Tr.	Eg.	1	11	8	"
"	I.,	Oc.	Dis.	2	6	10	"
"	I.,	Ec.	Re.	2	9	33	"
"	II.,	Tr.	In.	3	5	51	"
"	II.,	Tr.	Eg.	3	8	33	"
"	III.,	Oc.	Re.	5	8	22	"
"	III.,	Ec.	Dis.	5	10	53	"
"	I.,	Tr.	In.,	8	10	44	"
"	I.,	Oc.	Dis.,	9	8	2	"
"	I.,	Tr.	Eg.,	10	7	27	"
"	II.,	Tr.	In.	10	8	22	"
"	II.,	Tr.	Eg.	10	11	5	"
"	II.,	Ec.	Re.	12	7	50	"
"	III..	Oc.	Dis.	12	9	28	"
"	III.,	Oc.	Re.	13	0	9	morning
"	I.,	Oc.	Dis.	16	9	54	evening
"	I.,	Tr.	In.	17	7	4	"
"	I.,	Tr.	Eg.	17	9	19	"
"	I.,	Ec.	Re.	18	7	54	"
"	II.,	Ec.	Re.	19	10	26	"
"	III.,	Tr.	Eg.	23	6	9	"
"	I.,	Tr.	In.	24	8	58	"
"	I.,	Oc.	Dis.	25	6	17	"
"	I.,	Ec.	Re.	25	9	50	"
"	II..	Oc.	Dis.	26	7	48	"
"	III.,	Tr.	Eg.	30	10	8	"

	D.	H.	M.	
Saturn in meridian	10	8	6	evening
" "	20	7	26	"
" "	30	6	47	"

The rings of Saturn were in the best position, with respect to the earth, to be observed in October, but as their plane is elevated 13° above the earth, they can be readily seen now. It is a beautiful sight, which one never tires of. Evening after evening we involuntarily turn for a peep at the "ringed planet."

	D.	H.	M.	
Uranus in meridian	10	5	43	morning
" "	30	4	24	"
Neptune "	10	9	20	evening
" "	30	8	0	"

ECLIPSES, NEAR APPROACH OF PLANETS TO THE MOON, AND OTHER IMPORTANT PHENOMENA, DECEMBER, 1880.

Dec. 1. Partial Eclipse of the Sun, visible only in the Antartic Ocean.
" 2. Moon Perigee ; tide highest.
" 2. Moon lowest.
" 4. Jupiter stationary.
" 4. Venus 4° south of Moon.
" 5. Uranus 90° west of Sun (*quadrature*).
" 5. Venus 19° in Sagittarius.
" 10. Jupiter 6° South of Moon.
" 11. Saturn 8° South of Moon.
" 12. Neptune 6° South of Moon.
" 12. Mars 6° in Scorpio.
" 13. Mercury greatest elongation west, 21° 8′
" 15. Moon highest.
" 13—16. Mercury brightest, and visible as morning star.
" 16. Moon Totally Eclipsed; invisible in North America, except on the Pacific Coast, where the Moon sets at sunrise totally Eclipsed. Eclipse begins in San Francisco at 5h. 35m. morning; Portland, Or., 5h. 36m. morn.; Sacramento, 5h. 40m. morn.; and at Salem, Or., 5h. 44m. morn.

Dec. 17. Moon Apogee; tide lowest.
" 18. Uranus stationary.
" 19. Jupiter 9° in Pisces.
" 21. Sun enters Capricornus; winter begins.
" 23. Uranus 6° North of Moon.
" 23. Mars very close to Mercury; 1° south.
" 24. Saturn stationary.
" 26. Saturn 2° in Pisces.
" 29. Moon lowest.
" 29. Mars ½° North of Moon.
" 30. Mercury 12′ North of Moon.
" 31. A Partial Eclipse of the Sun. In the eastern part of the U. S. the sun will rise more or less Eclipsed. At New York City the middle of the Eclipse occurs at sunrise, and the end at 8h. 44m. morning.
" 31. Moon Perigee; tide highest.
" 31. Uranus 13° in Leo.

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS, DECEMBER 20, 1880.

	H.	*M.*	
Alpha Andromeda (Alpheratz) in meridian	6	2	even
Omicron Ceti (Mira) variable, in Meridian	8	13	"
Beta Persei (Algol) variable, in Meridian,	9	0	"
Eta Tauri (Alcyone or Light of Pleiades) in Meridian	9	40	"
Alpha Tauri (Aldebaran) in merid.	10	28	"
Alpha Aurigae (Capella) "	11	7	"
Beta Orionis (Rigel) "	11	8	"
Alpha Orionis (Betelguese) "	11	48	"
Alpha Canis Majoris (Sirius or Dog Star) in meridian	0	43	morn
Alpha Canis Minoris (Procyon) in meridian	1	36	"
Alpha Leonis (Regulus) rises	9	23	even
Alpha Virginis (Spica) "	1	58	morn
Alpha Bootis (Arcturus) "	1	1	"
Alpha Scorpionis (Antares) rises	6	4	"
Alpha Lyrae (Vega) sets	9	26	even
Alpha Aquillae (Altair) sets	8	14	"
Alpha Cygni (Deneb) "	0	36	morn
Alpha Pisces Australis (Fomalhaut) sets	8	50	even

THE MOON, V.—2d OR N.E. QUADRANT CONTINUED.

Between 110 and 112 are 61 minute craters, easily seen when the Sun is rising on the east side of the wall of Copernicus (112). The diameter of these craters has been variously estimated at from 400 to 700 feet. These craters are arranged mainly in rows, and so very close that but for the partitions they would form canals, which fact has lent strength to the belief that the so-called canals were originally continuous lines of craters. Above, and a little to the right, is Archimedes (120), a very large and regular walled plain 60 miles in diameter, with a wall averaging 4,200 feet above the interior, upon which are several high towers; the highest 7,400 feet. One astronomer has detected a minute crater within; a magnificent object against the rising or setting Sun. 129, and its companion to the right, are twin craters; depth of the companion estimated at 13,600 feet. Pico (131) is called an "insulated pyramid," and rises from a narrow base to the lofty height of 9,600 feet, and must form a fine sight from the surrounding plain. Plato (132) is another walled plain 60 miles in diameter, with three towers about 7,000 feet high. Some supposed craters have been observed within, but the peculiar feature of this object is the local shading of the interior. There is an alternation of light and dark bands within, which are believed to be variable. Sinus Iridum (P) is a beautiful object, almost as level as water, dark, semicircular, and surrounded by abrupt and high cliffs. The two promontories which reach out on either side are 140 miles apart, and very high and abrupt; best seen two or three days after First Quarter. Aristachus (148) is considered the brightest crater in the Moon, and is quite beautiful, even in a small telescope. The steep central hill shows with fine effect four or five days after First Quarter. The ring is 28 miles across, and in the west rises 7,500 feet above its inner, and 2,600 above its outer base. On the east the ring becomes a plateau, connecting it with the steeper crater Heroditus (149), north of which is a curious serpentine valley, nowhere exceeding 2½ miles in width, not unlike a dry river-bed. Owing to the great reflective power of this object, Herschel the I. mistook it for a volcano in eruption. It may be seen with the naked eye when on the bright side, and with a telescope when on the dark side. Above, and a little to the right are several mountains, the highest 6,300 feet. Pythagoras (176) is the deepest walled plain in this quadrant, measuring some 17,000 feet on the S.E. side.

These are the abbreviated descriptions of the most remarkable objects in the 2d or N.E. Quadrant, still leaving the whole southern lunar hemisphere untouched.

Penn Yan, N. Y.

Welding Cast Steel Cold.—A writer in the *Blacksmith and Wheelwright* says: "Cast steel can be welded cold by simple hydraulic pressure. Incredible as it may seem, it has often been done." We know that lead and the softer metals can be welded by great pressure but we were not aware that pieces of steel or iron could be so united.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business letters or cards they cannot be used.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

To exchange, an $8 Challenge self-inking printing press, chase 3 x 5 inch, for type or offers. Address, by sealed envelope, Wm. F. Hill, 666 Bergen St., Brooklyn, N. Y.

To exchange, a $60 Wardwell (2 spool) sewing machine, nearly new, also a $3.50 stylographic pen, for coins and books, or offers. C. C. Bulkley, 195 Sigourney St., Hartford, Conn.

Wanted back numbers of "American Naturalist" and "American Journal of Science and Arts" (Silliman's Journal), for beautiful specimens, named, of American ferns, mounted or unmounted. Box 16, Pine Plains, N. Y.

Wanted, to correspond with some one living near the ocean beach; also some one living near any lead or copper mines. Ewing McLean, Greencastle, Ind.

Beautiful Beryls, Garnets, Tourmalines, Rose Quartz, Muscovite, Granites in variety, etc., to exchange for coins, shells, fossils, minerals, books, magazines—anything. Describe offers fully. C. Le R. Wheeler, Wilmot, Merrimack Co., N. H.

To exchange for 1 new Vol. II, Young Scientist, 1 new Vol. I of ditto, and Prof. Bell's Lectures on the Telephone. F. H. Burger, Chester, Pa.

Wanted, specimens metallic ores; will give in exchange fossil shells, Vicksburg epoch, Tertiary period; state kinds of ore. Philip Crutcher, Warren Co., Vicksburg, Miss.

I have 2,000 foreign stamps that I would like to exchange for others. F. Cushing. P. O. Box 178, Wattsburg, Erie Co., Pa.

An Official Printing Press, must be in good order, and type to make a complete printing outfit; state what is wanted in exchange. W. E. Cushman, Hartford, Ct.

Minerals, birds eggs, shells, woods, stamps, nests, books, insects, etc., to exchange for coins, stamps, minerals, birds eggs, insects, and fossils; send for my lists. Frank F. Fletcher, St. Johnsbury, Vermont.

Wanted to exchange 1 copy of Instruction in Wood Engraving, or set of dozen prints, suitable for practice, for specimens of algæ or minerals. S. E. Fuller, 25 Bond St., New York.

Wanted, copy of book called Corner Cupboard, and other scientific books; state what is wanted in exchange. G. S. Griffin, Emporia, Kansas.

I have some stamps which I will trade against other stamps, or offers; please send list of stamps you have to exchange. J., 226 West 22d St., New York.

Mosses from Germany, Colorado, and Illinois, also plants, Phænogamous and Crytogamic, to exchange for other mosses, lichens, liverworth, or algæ, East and South. Prof. P. Fr. Shuelke, Box 128, Pekin, Ill.

Wanted, a household microscope, telescope, large lenses, well-mounted slides for the microscope, books on the microscope or entomology, in exchange for stuffed birds or minerals; describe offers, and state what is wanted in exchange. E. O. Tuttle, Hampden, Mass.

A large number of books, papers, and magazines, to exchange for type, printing material, or offers. J. T. Jackson, Box 48, Metuchen, N. J.

Minerals to exchange for other minerals; state what specimens you have for exchange. Samuel Wynne, Box 54, Phoenixville, Pa.

Will exchange, for printing outfit or shot gun, 6 years Nos. of Scientific American, with Supplement of 1876, 545 foreign and U. S. stamps, Art of Swimming, Instruction in Shorthand, and other books. W. A. Smith, West Randolph, Vt.

Insects and butterflies from China; state what is offered in exchange. Edward Laurent, 621 Marshall St., Philadelphia, Pa,

I have a four-legged and four-winged one-headed chicken, in alcohol, which I should like to exchange for a good breech-loading shot gun, or for standard scientific books. A. H., Box 500, Albion, Ohio.

Good Specimens of the 17 years' locust (17 year cicada), in exchange for any kind of insects, beetles, moths, or butterflies. Harry C. Beardslee, Painesville, Lake Co., Ohio.

Wanted, scientific books, minerals, fossils, and Indian relics, in exchange for minerals, fossils, coins, old Continental and Federal money over one hundred years old (very rare), foreign stamps, A. W. Baily, Box 712, Atlantic City, N. J.

Birds eggs, books, foreign stamps, a good hammock, and revolver, to exchange for birds eggs and works on birds. F. D. Brown, Gallupville, Schoharie Co., N. Y.

A magic lantern with eight slides, cost $5, and other things, to exchange for scientific books, chemicals, or chemical apparatus, etc. A Campbell, Box 31, Derrick City, McKean Co., Pa.

Idaho Mineral Specimens, for bound books on science, travels, history, biography, political, masonic, and others that are instructive. J. P. Clough, Junction, Lemhi Co., Idaho.

I have minerals (including fossils and dentrites), to exchange for minerals; also a papyrograph outfit, without press (worth $25), for offers. W. H. Eastman, Hyde Park, Mass.

Klose's celebrated "School for the Clarionet," new, $3; will enchange for telescope, microscope, piccolo. books, or offers. Rush Holbrook, Wonewoe, Juneau Co., Wis.

One or two handsomely mounted red deer heads, attractive ornaments for any dining-room or hall, for microscope, telescope, sporting implements, camping outfit, scientific books, or offers. R. B. Hough, Lowville, Lewis Co., N. Y.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

VOL. III. NEW YORK, DECEMBER, 1880. NO. 12.

Ivory Pagoda.

PERMIT me to answer through the columns of your valuable journal, a query that appeared in the last number, relative to the production of an ivory pagoda. For I have made one of these somewhat elaborate ornaments, which has been much admired, I need not say, much to my satisfaction.

First, then, the base to begin with. This was made of African blackwood, and to procure a piece of sufficient diameter was some considerable trouble, but I did, after all, and the diameter represents 6½ inches. This I screwed on to the largest worm or screw-chuck I have, which has a good large flange to it, consequently giving a good surface for the wood to bear against. Having well chucked it, I may say to turn it clean all over was the next operation. This done I set the drill-spindle with a drill I had especially made to make a half-inch hole, these being for the base of the pillars, eight in number, to fit into. Now to make the pillars, no difficult matter some readers may say, as far as one is concerned, but I found to make the eight all alike a difficult task, but by perseverance, and a little advice from one I will not mention, I arrived at a good plan, viz., I first cut off the eight pieces all one length, and made a corresponding number of small boxwood chucks all exactly the same length or distance from the nose of the mandrel, then turned the pillars to fit the holes already made in the base, and then fitted each one into one of the said chucks. I then set the slide rest to the desired taper, and made a note of what angle it was in case of its shifting by any means, and with the fluting-stops adjusted to the length began to turn them up. One being done, nothing remained but to take it off, chuck and all, and replace it by another, the stop screws of the top slide saving all necessity for the use of callipers, and when they were all done, much to my satisfaction, I

found they were all exactly alike in shape and size, and to flute them the same process was again gone through. Having gone so far, the next part was to place on the top of these pillars, a second piece of blackwood. This I did by screwing it on the smaller worm chuck, and drilling eight smaller holes than those in the bottom, to receive the top of the pillars, of course using the same division, with the drill set exactly to the same distance from the centre as when drilling the lower holes, and upon placing the top on its place, found all came square and upright; but upon proceeding I unfortunately found that I had made my slab too thin, forgetting that I wanted the bottom of the next tier of pillars to fit in the same hole. Here, as in many cases, the fact of an error often results in something more effective than the original idea would have been; in my case it certainly was so. Finding I had no room for what I wanted, I was of necessity compelled to place the second row of pillars between those at the bottom, and cover the holes already made with small ivory buttons with an eccentric pattern cut on them. This turned out very effective. Now the second series of pillars I desired to cut with a pattern of the same description your correspondent desires. Now this pattern is called the geometric staircase, and does to an extent represent a number of discs placed one on the other. To produce this, I used the eccentric chuck, and I give the setting as nearly as possible. The diameter of pillar one-half inch, the eccentricity of chuck throughout one-tenth. Use a small square chisel-tool in the slide-rest one-twentieth wide. The milled head of slide-rest must of course be set at zero, and this will necessitate moving it just one-half round, to shift the tool exactly its width. Having done the first cut, the dividing wheel of the eccentric chuck must be turned round one division of 96, and by proceeding in this way, the result will be what I say, a series of discs one on the other, and in a spiral form.

One little difficulty I found from the length of the pillars, which had to be supported by the poppit head, and when the wheel is shifted, a different centre is required for each cut. In order to obtain this, a flat end must be left, and before shifting the wheel for each alternate cut, the centre must be withdrawn and then replaced. It is rather a tedious job, and I for one was very glad when I had finished them; but the result amply repaid me for the trouble.—*H. Melvill in Forge and Lathe.*

Three Amateur Workers—and What They Did—IV.

BY FRED. T. HODGSON.

HAVING described the planes and their uses this far, Mr. Carpenter proceeded to explain to the boys how these tools were to be kept in order. He struck the "starter" on the jack-plane, which

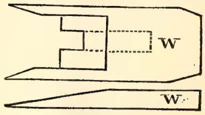

Fig. 12.

loosened the wedge and iron; he then slackened the screw in the rim and took it apart. The cutting part being new, as a matter of course it wanted sharpening,

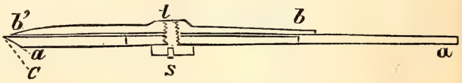

Fig. 13.

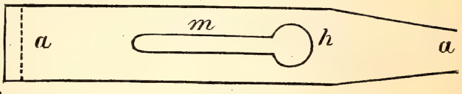

Fig. 14.

and as he had purchased an oil-stone along with the other tools, he produced it, and began to show the boys how to use it. Ellwood fairly screamed with delight when he saw the oil-stone, which was a

Fig. 12. w w, shows the wedge for adjusting and holding the iron, in two views.

Fig. 13 shows the "double iron" ready to put in the plane. The lower iron, *a a*, is the cutter, and the upper one, *b b*, is the cap. This cap serves a double purpose; first, to give the shavings the proper direction, and second, when placed close to the cutting edge, it prevents the cutter from tearing up cross-grained stuff. The two irons are

fine white Washita stone, nicely fitted in a walnut-wood box, which parted in the centre when opened for use. "Oh," said Ellwood, "that will be bully to sharpen

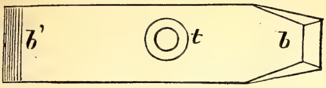

Fig. 15.

my jack knife on." "All right," said his father; "you may sharpen your knife on the stone, but you must be very careful and only use the ends of the stone, for if you rub your knife in the centre it will soon wear away, and become hollow, and then plane irons or other edge tools cannot be sharpened on it with any degree of satisfaction."

Mr. Carpenter warned the boys against using inferior oil on the stone. "If possible," he said, "always use pure sperm oil; lard or olive oil answers very well, but when used the stone should be fre-

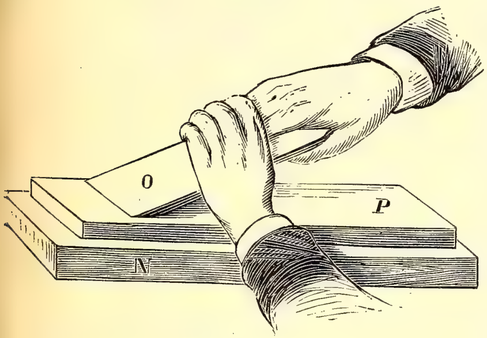

Fig. 16.

quently cleaned off, or it will get hard and full of dirt. Kerosene is excellent for cleaning an oil stone, and may be used occasionally for sharpening with. If at any time you want to sharpen a chisel or a plane iron, or other tool, and have no oil to use on the stone, you may use a little castile soap and warm water. This merely answers a purpose, and should not be resorted to oftener than can be helped.

"When sharpening a plane-iron, you should grasp it in the right hand, and place the fingers on the surface and the thumb underneath. The fingers of the left hand should be lapped over those of the right, and the thumb should be placed underneath to support the iron, which should be held at a constant angle of about thirty-five degrees, and kept square across the face of the stone. If, as may sometime happen, you have an iron that is wider than the stone, you must work it from side to side, so as to make the corners uniform with the middle. When the edge of an iron is required to be a little rounding, as is sometimes wanted in a jack-plane, a light roll must be given to the blade edgewise. You must not press too heavily on the iron while sharpening, as the edge will be liable to bend over, and become what is called 'wire edge.' When you think your iron is sharp enough you must turn the flat side down, keeping it *quite flat* on the stone, and gently rub a few times to remove the wire edge, if any has formed.

"If you hold the iron too upright, the edge will be too quickly produced, and will wear off much sooner than if the iron had been held, during the sharpening process, at a lower angle. You can easily see that if an iron is sharpened at an angle of forty-five degrees, which is the pitch at which it is fixed in the plane, the chamfer formed by the oil-stone would rest on the work, and would, consequently, prevent the edge from cutting. On the other hand, if the angle be too acute, the edge will be too thin to be durable; therefore, the angle of thirty-five degrees is probably the best angle for planes, chisels, and similar tools.

"It is always well to take the corners off the iron, for if they are left on they will be apt to leave marks on the work, and this will not be very nice."

Fred, under his father's immediate supervision, tried his hand at sharpening up the plane irons, and considering that this

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held together by the screw, s, which is "tapped" into the boss, *t*, formed on the cap-iron, which is shown separately in Fig. 15.

The cutting iron is shown disconnected from the cap-iron in Fig. 14. The long slot, *m*, admits of the iron being adjusted longitudinally, and also, to a slight extent, sideways. The round hole, *h*, is a little larger than the head of the screw *s*, which permits of the irons to be taken apart without taking the screw, *s*, out entirely.

Fig 16 shows the method of holding the plane-iron during the process of sharpening. O is the iron, P the stone, and N the box in which the stone is cased.

was his first attempt, he made a pretty good job; it took him some time, however, before he could get rid of the rocking motion that all young persons seem to have in their hands when they first try to sharpen up a plane iron.

Mr. Carpenter was very particular in his instructions regarding the method of sharpening tools; and this was right; for it is very important that every young workman should know how to put and keep his tools in good order. And besides knowing how to put and keep them in order, it is equally essential that they *should* be kept in order, for it is impossible to do satisfactory work with dull tools, or tools that are in bad shape, or not properly sharpened. It is an old saying, that "A bad workman quarrels with his tools." The real trouble, however, is, that a bad workman does not know how to put his tools in order; if he could have managed his tools all right he would not have been a bad workman. As a rule, it requires more skill to care for and properly manipulate tools, than to do the work; hence, it will be seen that Mr. Carpenter was perfectly right in impressing on his boys' minds the necessity of taking great care of their tools.

A few evenings after this, Mr. Carpenter and his three children were again in their workshop, where everything had been made nice and clean by Jessie, the day previous.

"Now then, Fred," said Mr. Carpenter, "I will show you how to use the planes and saws, and after you have acquired the 'knack' of properly handling them, you may teach your brother Ellwood.

"In the first place, we will take a piece of inch stuff—all boards, planks, and scantlings are called 'stuff' by workmen, and, for the sake of brevity and convenience, we will adopt their modes of expression—three or four feet long, and from six to ten inches wide. It is rough, just as it came from the saw mill; we will lay it on the workbench, placing one end against the stopper. Now take the jack plane, see that the iron projects just a little beyond the face of the plane; grasp the handle in the right hand, place the left hand on the front of the plane, keeping the thumb towards you; now then, push the plane forward, pressing it down on the work during the cut; this you can do with very little exertion, if you slightly incline the body so as to cause its weight to rest partly upon the plane. On the return stroke the pressure must be discontinued to avoid friction on the edge of the iron. Indeed, it is sometimes better to lift the heel of the plane up altogether, on the return stroke, as by this action the iron will remain sharp a greater length of time, particularly is it so when the surface of the stuff is full of sand or grit."

Fred made a very creditable attempt—for the first one—with the jack plane, and the way he made the shavings fly, filled Ellwood and Jessie with delight. To make a shaving two feet long, seemed, in Jessie's eyes, something wonderful.

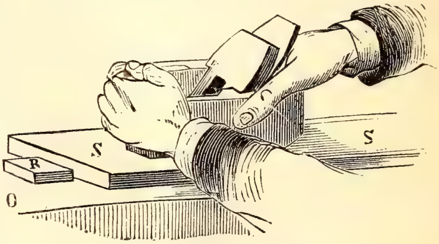


Fig. 17.

Fred planed off the board to the satisfaction of his father, and seemed quite pleased to think he had accomplished so much.

"But, Pa," said Fred, "What is it makes all these marks on the board where I have planed it?"

"Ah!" said his father, "There will always be marks left on a surface after a coarsely set jack plane. We must now have the board smoothed off with the smoothing plane, which, you will see, will make a nice smooth surface."

Fred then took the small plane, and, after receiving some instructions from his father, fell to and smoothed off the surface very nicely, much to the delight of his brother and sister.

(To be continued.)

Fig. 17 shows how Mr. Carpenter taught Fred to hold the smoothing plane when using it to smooth up stuff. R shows the stopper in the bench, O the work-bench, and S S the stuff being smoothed.

Apparatus for Preparing Caterpillars for a Biological Collection.

THE most common method for inflating and drying caterpillars, is that the caterpillar, after emptying its body of intestines, etc., by gentle pressure from the head toward the anus, be blown up with a straw inserted into the latter, and then be dried over the flame of an alcohol lamp.

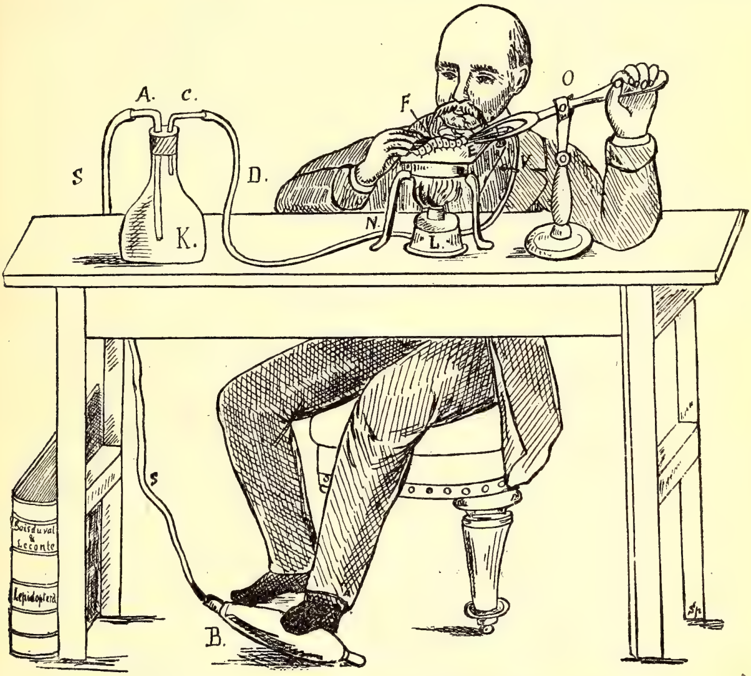
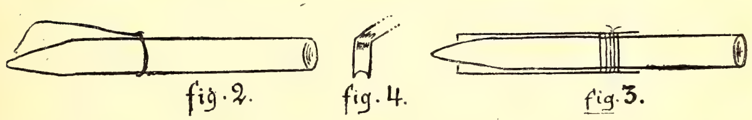


Fig. 1.—APPARATUS FOR PREPARING CATERPILLARS.



This method has two faults, first, that only one hand can be employed to give the body the required shape, and the other, that it becomes somewhat disfigured at its end by the inserted straw.

The Brooklyn Entomological Society has a collection of prepared caterpillars of butterflies, each specimen pasted on a piece of card-board with shellac solution, the card itself being held in a horrizontal position by an inserted entomological pin. The specimens show their natural forms as well as colors beautifully, and have been prepared by some members of the Society in the following improved manner. The bottle K, is tightly closed by a cork or rubber. Two glass-tubes, bent at right angles as shown, pass through the cork, the one A having a larger diameter, is connected by the rubber tube S, with the rubber bellows B, the smaller one C connects by the rubber tube D with a finely pointed glass tube E, on which the caterpillar-skin F is secured. The glass tube is held by the stand O, which allows vertical and horizontal movements, thereby facilitating the approach of the caterpillar to the heated metal plate that rests upon the tripod N, under which is placed the gas or alcohol lamp L.

The bellows is worked by the foot, and the air passing through the rubber tube S, and the glass pipe A, is compressed in the bottle by reason of the smaller diameter of the exit pipe C, causing a continuous and uniform current of air, which can be still further controlled by opening or closing the cock V. If it is desired to introduce warm air into the caterpillar-skin, the bottle K may be placed upon a sand bath. The size and fineness of the point of the glass pipe E upon which the skin is secured, depends upon the size of the caterpillar, therefore sevral sizes of them should be at hand.

To fasten the skin upon the glass-point, wind a common insect-pin around the glass, bend it along the pipe and make a small hook of the pin point, (See Fig. 2) or bind with thread two springs to the pipe, as shown in Fig. 3, having them bent rectangularly at the end, and the tips fitted to the pipe, Fig. 4.

Collodio Etching—II.

BY BENJAMIN HARTLEY.

BEFORE taking up the several details of the picture, I must go back a step to say a few words more about the plate. In the last number, I said that the plate had better be varnished when beginning to practice. Supposing, now, that you had made the attempt, you have discovered that the varnish is rather hard to scratch, and that is just why I told you to use it. When you draw on the collodion film without it's being varnished, you have to be exceedingly careful, as the film is very tender and delicate. Now I imagine you sitting with your unvarnished plate, and I know your first question must be, "How shall I get my sketch transferred to it?" Of course you cannot do as before intimated, that is, turn it over and rub it on the back, for by so doing you would ruin your plate. You must draw it directly on the film. This is somewhat difficult with a pencil, because, no matter how soft it is, it will now and then catch on some particle of grit, and make a line through the film when you only desire a tracing on the top, to be filled up afterwards by very different lines with the needle. You require first simply to "block in" your subject, and for doing this you will find a very small, sharp-pointed stump or blender to be the most useful tool. Those made of wash leather are to be preferred to the paper ones, *provided* they have good points. With one of these stumps you can indicate the outline, and, if used gently, the false strokes will not injure the drawing. When your picture is thus sketched, you take your finest needle and proceed with the distance as before stated.

The reversing of the picture is another point I promised to explain. If the picture to be copied is *not* just the right size for your plate, you must make an outline sketch of it, the proper dimensions. Then, placing a piece of transfer paper on your table or drawing board, put on it a piece of drawing paper, and on the top lay your sketch and go over the lines with a pencil or ivory point. When this is done you will find on lifting the paper an exact reversal of your subject which you can easily copy on the plate.

Now we will take up the details of the picture. I can only give a few general hints, but hope they will be sufficient to guide the amateur in his studies. First then, take the water. If it is still, as in a pond, or smoothly flowing, as in a deep river, the lines must be kept very straight, both horizontally and perpendicularly, in order to give the effect of transparency and flatness. Let the lines be few, except in the reflections. To represent the current of a stream, lines are used which are sometimes curved, but more frequently straight, although not horizontal, as they all run towards some perspective distance or vanishing point. In broken water, such as rapids, cascades, etc., the lines must follow the direction of the flow. To study the finer points of treatment you must examine closely the best etchings and engravings you can find.

In regard to trees, I would remark that if they are in the distance, the small curved lines are the best—a series of little curves forming the outline of the tree or bush. If they are near the foreground, then you must show the character of the tree in the treatment of the trunk,

whether smooth like the beech, or rough like the oak, just as you do in pencil drawing. The foliage is then represented by either the curved or the angular, zig-zag line. In all cases the line must follow the masses of the leaves.

In treating rocks you will find that the rough texture will be obtained best by short, sharp cross-lines.

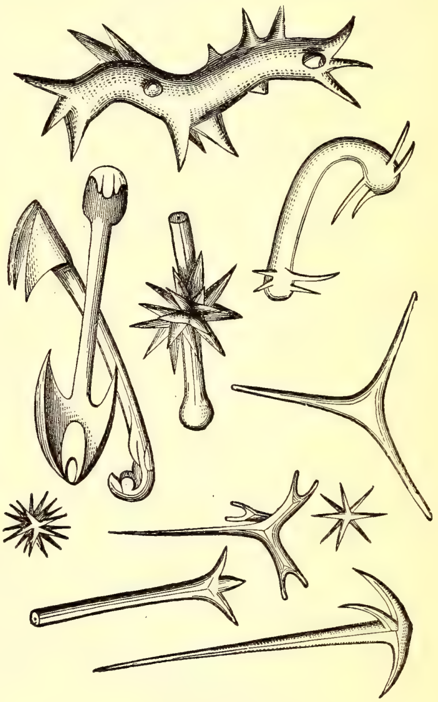
Now it only remains for me to speak of the sky, which with beginners is always a puzzle. It is best to leave it alone until you have gained considerable delicacy as well as freedom of touch. The sky is sometimes the most important part of the whole picture, and I would advise you to make a special study of the manner in which our painter etchers are treating the subject. As a rule, you must either leave it white, or go over the whole space intelligently; not necessarily covering it with lines, but indicating all that goes to make up the effect in outline. If you wish to represent a perfectly clear sky, by lining as engravers do, you must keep the lines close together at the top, and draw them finer and wider apart as you descend to the horizon; but they must be *very* delicate, or you must treat them with stopping out varnish to make them print lightly. In cloudy skies the top is frequently the lighter part, and near the horizon the darkest; but remember that no portion of sky or cloud must be as dark as the shadows on the ground.

[It is, of course, impossible to give an actual illustration of these etchings in the journal, but in a future number we shall give a *fac simile* engraving of a very fine etching, which has been sent to us by Mr. Hartley. This will enable our readers to judge of the capabilities of this method.—ED. Y. S.]

Sponge Spicules.

WHEN our young readers take a sponge in their hands, they probably little think of what it is, and of its curious structure. The common sponge used in the bath-room, is the type of a very large family, the members of which differ widely amongst themselves. Some kinds inhabit our fresh water streams and lakes, but these are generally small, and comparatively few people, even amongst those who have given some attention to the inhabitants of fresh water, are familiar with them. The sponges vary so much in appearance and character that some of them would hardly be recognised as belonging to the same group. Thus, for example, few would suppose that the coarse sponge used by stable boys, and for other rough work, is any relation to the beautiful Venus Flower Basket, which is so prized as an ornament for the mantel piece? and yet they are both sponges.

The beautiful frame work which we know as Venus' Flower Basket, is really the siliceous or flinty skeleton of a kind of sponge, and other kinds of sponges are also provided with these flinty frames, though none are so perfect and beautiful as the one just named. In general the



SPONGE SPICULES.

flinty part of the sponge takes the form of a collection of spicules, and these spicules are found in the most diverse forms, some of which we have figured in the accompanying engraving. Some, as the uppermost one, is simply a rough body armed with spines; others take the form of stars; others of curious club-shaped rods, while others take the form of anchor-

shaped bodies, similar to the curious anchors found in the skins of the so-called sea cucumbers.

It is only in a certain class of sponges that these flinty spicules are found. They are not found in the common sponge, and, indeed, if present there, they would detract greatly from the value of this useful article, which is prized chiefly for its softness and the flexibility and elasticity of its parts. Sponge spicules are often found in a fossil state amongst diatoms, and have given rise to the most curious speculations. They are generally found mixed with diatoms, and have remained after all the fleshy parts of the plants and animals have disappeared.

These spicules are not only curious, but beautiful objects under the microscope, and it is well for those who are beginning the study of objects with this instrument, to become familiar with these curious forms, so that they may be able to know them when they see them.

Editorial Notes

The Close of the Volume.

THIS number brings the third volume of THE YOUNG SCIENTIST to a close, and on reviewing the labors of the year, we feel certain that our unpretentious volume will compare favorably with any similar amount of matter that can be obtained for the same price. Some of our articles may perhaps have been a little beyond the grasp of the average reader, but, on the other hand, we are glad to know that some who began with us three years ago, have made wonderful progress in practical scientific work, and are now able to put in practice things far more difficult than anything we have yet published.

The YOUNG SCIENTIST for 1881, opens with encouraging prospects. We have made arrangements for a large number of practical articles of great value, and we hope to present to our readers twelve numbers of unequalled interest and usefulness. Amongst the articles which we shall publish at an early day, will be one on iceboats and how to make them; a series of elementary articles on the lathe, and how to use it; several practical articles on carpenter's tools; on the use of the microscope, and the preparation of objects, etc., etc. Simple scientific experiments which afford both instruction and amusement, and which are free from danger, will also be a feature of the YOUNG SCIENTIST for 1881. With such a bill of fare we look for a larger subscription list, and trust that all will aid us to achieve this very desirable end.

Postage Stamps.

WE again call the attention of our subscribers to the fact, that while we take postage stamps of small denominations at full value, those of higher denominations are of no use whatever to us. We cannot sell them, except at a very great loss, and the post office will not exchange them for smaller denominations. Therefore, please do not send them.

Removal of Strong Odors from the Hands.

Ground mustard, mixed with a little water, is an excellent agent for cleansing the hands after handling odorous substances, such as cod-liver oil, musk, valerianic acid and its salts. Scale pans and vessels may also be readily freed from odor by the same method. A. Huber states that all oily seeds, when powdered, will answer this purpose. In the case of almonds and mustard, the development of ethereal oil, under the influence of water, may perhaps be an additional help to destroy foreign odors. The author mentions that the smell of carbolic acid may be removed by rubbing the hands with damp flax-seed meal, and that cod-liver oil bottles may be cleansed with a little of the same, or olive oil.—*Druggist's Cirlar.*

Ceresine.—This is a new substitute for beeswax, obtained by chemical processes from a waxy mineral known as ozokerite. It is sold in thin white cakes, and is pure white, scentless, harder than wax, and partially translucent. It cannot be softened in warm water, and is not liable to the action of acids or caustic alkalies. It is volatile at a high temperature, and can be distilled unchanged. For many purposes it will doubtless prove of great value, and it is to be hoped that our dealers will soon have it for sale in this country.

OUR ICE BOAT.

The Young Scientist

SCIENCE IS KNOWLEDGE. KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

VOL. IV. NEW YORK, JANUARY, 1881. No. 1.

Our Ice Boat.

BY WHIZ.

WE HAD spent an unusually pleasant summer, rowing and sailing on an inland stream. And when Jack Frost came and solidified the glassy surface of our boating place, we, determined not to be deprived of our favorite recreation, built an ice boat.

We had read descriptions of the large ice boats which are used on the Hudson, and on Toronto Bay, but we had never seen one.

Our ice boat was decidedly an amateur affair; it was small and adapted for the limited stretch of ice on which it was used. The mast, sail and rigging were transferred from our sail boat; the skates or runners, were made by a country blacksmith; the wood work we made ourselves.

Our ice boat was a success. With an ordinary wind it carried two persons, and with a stiff breeze, it glided swiftly over the ice with four of us.

With the aid of the engravings, we propose to tell the readers of the YOUNG SCIENTIST how it was built, so that if they wish to try ice boat sailing, they may know how to build a boat for themselves.

The ice boat is, properly, a triangular frame, each angle of which rests on a runner or skate. The main piece in the frame is the centre piece or keel, A C B, as shown in the plan and side view. It is a 3 x 4 inch scantling, set edgewise, and is 16 feet long. 5½ feet of the forward end, C B, is tapered on the under edge and sides, and is rounded so that it is about 1½ inches in diameter at the end B.

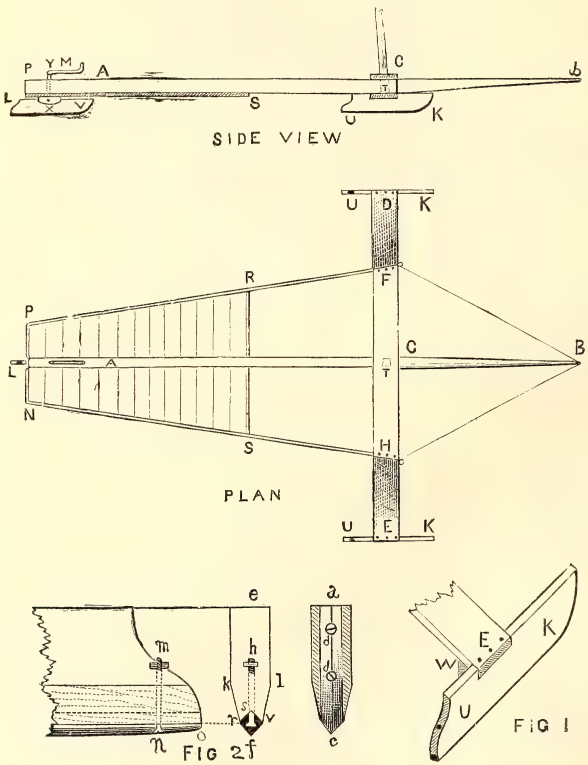
The lower cross piece, D E, is 1½ inches thick, 10 inches wide, and 10 feet long. It is nailed firmly to the under edge of the keel. Its middle point T, being made 6 feet from B, and the distance from T to each of the ends D and E is 5 feet.

The stern, N P, is 1½ inches thick, 4 inches high and 2 feet long. It is nailed at its middle point to the rear end of the

keel. The sides, F P and H N, are each $1\frac{1}{2}$ inches thick, 4 inches high, and about 11 feet long. They are nailed to the stern at N and P, and to the top of the lower cross piece at H and F. The distances T F and T H, being each 3 feet. The top cross piece, H F, is $1\frac{1}{2}$ inches thick, 10 inches wide and 6 feet long. It is nailed to the keel at T, and to the side pieces at H and F.

The mortice, T, to hold the foot of the mast, is made through the top cross piece the voyagers, and the floor should be securely fastened, else they may at some inopportune moment be let unexpectedly down into the ice.

The runners, K U, are each 3 feet long, 2 inches thick, and 7 inches high; they are fastened firmly to the ends of the lower cross piece at E and D, and parallel with the keel as shown in Fig. 1. The cross piece being at right angles with the keel. W is a corner block, which is



down into the keel, care being taken not to weaken the keel by cutting out too much wood.

The piece R S is $1\frac{1}{2}$ inches thick, and 4 inches deep. It is fitted and fastened between the keel and sides about 6 feet from the stern. The space included within R S N P, is boarded on the under side of the keel and sides with $\frac{3}{8}$ inch match boards, fastened with $1\frac{3}{4}$ inch screws. This is the portion of the boat which is occupied by screwed firmly to the runner and the underside of the cross piece.

The bottom edge and forward end of the runner is grooved, as shown at *r s v*, Fig. 2, to hold the iron skate in place. The skate is made of $\frac{3}{4}$ inch square iron, set cornerwise in the groove, as shown at *f r s v*. It is bent up in the shape of a skate or sleigh runner, to fit the forward end of the runner, and is fastened with two $2\frac{1}{2}$ inch screws, as shown at *d d*. The

running edge of the skate is filed away a little at the rear end *n o*, and it is fastened to the runner at *n*, with a quarter inch bolt 3 inches long, as shown at *m n*. The skate should be made slightly concave on its lower edge, so that when it is drawn up, by the bolt *m n*, it will be tight against the entire bottom of the groove in the runner. When it is drawn up into its place, it must be perfectly straight on the bottom or running edge.

Any good blacksmith can make the skates at slight expense. Care must be taken to keep the running edge, *f*, sharp. If any part of it becomes battered it must be smoothed and sharpened with a file. No difficulty is experienced in drilling the holes, *d d* and *n*, through the iron cornerwise, if a flat spot is first filed, so as to start the drill.

The sides of the runners are sloped from the skates to a height of 2 inches as shown at *v l*, and *r k*.

The steering runner V L, is the same length and thickness as the forward runners, but is only about 5½ inches high. A circular block 12 inches in diameter and 2 inches thick, is fastened to the top of the runner as shown at X, so that its centre is directly over the middle point of the running edge of the skate. The tiller shaft, X Y, is a piece of inch round iron about 10 inches long. It is squared and slightly tapered at its lower end so as to fit tightly into a mortice in the block and runner. Its top end, Y, is squared to fit the socket of the tiller, M. The shaft is fastened to the runner by a screw or pin through a hole drilled for the purpose, shown at X.

A one inch hole for the tiller shaft is bored down through the middle of the keel at a point about 12 inches from the stern. A piece of half inch board, 12 inches in diameter, with a one inch hole through its centre, is screwed to the underside of the floor, so that the hole coincides with the hole bored through the keel. The board should be placed so as to afford a smooth bearing for the block on the runner. The hole must be so that the tiller shaft will turn in it easily, and yet not have too much play. If the bearing surfaces are rubbed with a mixture of stove blacking and oil, the friction will be greatly reduced.

The tiller handle must be fitted to the shaft so that it will be exactly in line with the runner. The boat is steered just the same as any sail boat, but it is much more sensitive to the action of the rudder.

The bowsprit is stayed by lines from B to F and H. The mast is stayed by lines to the same points.

When the boat is on a level place, the frame should be level and the entire running edge of each skate should have a full bearing on the ice.

Three Amateur Workers—and What They Did—V.

BY FRED. T. HODGSON.

THE next thing Fred was instructed to do was to joint the board he had "dressed,"—and here let me explain what is meant by "dressed" when used in this connection: "dressed" stuff is that which has been taken from the rough, and planed and made smooth. Stuff is said to be "dressed" on one side, when only one side is planed. When one side and one edge, or both edges are planed, it is said to be "dressed" on one side and one edge, or one side and both edges. And when planed on both sides and both edges, it is said to be "dressed" all round.

To joint the board conveniently, it was necessary to place one end in the bench screw-chops, the other end being held up in place by the movable peg in the side of the bench. In jointing the edge, Fred found that he had to hold the jointer plane somewhat differently than he held the jack plane. The thumb had to rest on the top of the plane, and the fingers were bent under the face to support it, the narrow edge of the board not affording sufficient base to keep the plane steady.

The sole of the plane must be kept at right angles with the side or face of the board whilst jointing. The reason of this is quite clear; for it must be evident that if the joints of two boards are to fit with their edges together, they will not

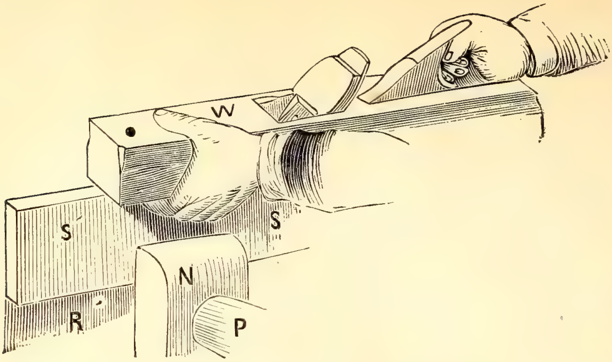


Fig. 18.

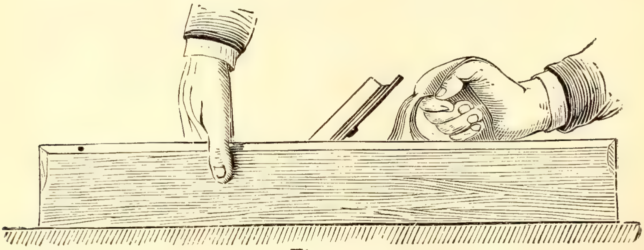


Fig. 19.

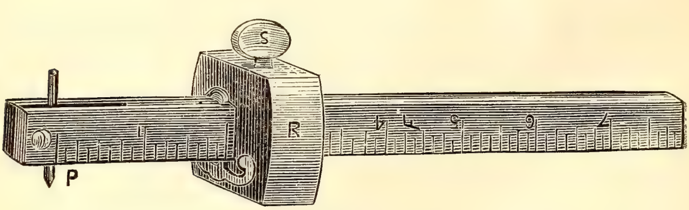


Fig 20.

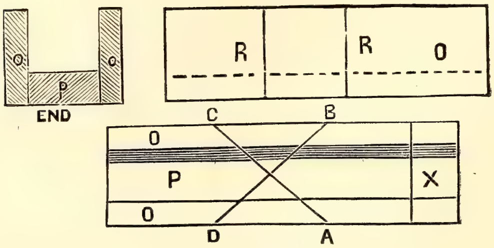


Fig. 21.

Fig. 18 shows the method of holding the short jointer or fore plane, when jointing thin stuff. S S, is the stuff being jointed, N the screw-chops. P the screw head, R the bench, and W the fore plane.

NOTE.—An absolutely true surface is a theoretical impossibility, though surfaces are made so true that the most accurate measurements are not capable of discovering their defects.

Fig. 19. This cut shows how the long jointer should be held when jointing or truing stuff.

Fig. 20. shows a common gauge. R is the head. F the stem. P the spur. S the tightening screw.

Fig. 21 shows the end, side and plan of the mitre box. O O and P shows sections of the sides and bottom, C. A. B, D, show how the box is cut for a mitre. X shows how it is cut for a square cut. R, R, O, show the side, with the cuts.

form a fair surface if the jointing edges are not square as well as straight.

Mr. Carpenter fully explained this matter to Fred and Ellwood, and both boys seemed to understand their father quite well; so after instructing them a little further in the use of the three planes and the two saws, he took from a shelf, where he had previously placed it, another plane much larger than either of the ones the boys had been using. "Now," he said, "I will show you how to use this long plane; though, in your amateur work, you will not have much need to use it, for the short jointer will nearly do all the jointing you will have to do."

"Is that the long jointer, Pa?" said Ellwood.

"Yes," said Mr. Carpenter, "this is a long jointer, and great care must be taken of it, for it is so long that it is easily warped or twisted on the face. It is chiefly used for jointing long stuff, and in the hands of a good workman is capable of doing good service. When this plane is as near "true" as it can be made, and the iron is in proper condition, it can be run along the edge of a board four or five feet long, and if it takes off a fine ribbon shaving from end to end without a break, the edge is as nearly straight as it can be made, providing it was first hollowed out a little, for you can see, that if the edge was slightly rounded, or high, the iron could cut it, even if the wood of the plane did not touch the edge."

"If I hold this plane in a similar manner to the way I hold the short jointer, won't it be all right Pa?" said Fred.

"Well," said Mr. Carpenter, "some persons do hold the long jointer the same way they hold the shorter one, but I don't think they get such good results when they adopt the latter method. You will soon discover which method suits you the best, and, of course, that is the one you will adopt."

"I think," he continued, "that you are pretty well informed as to the use of the bench planes now, so far as regards ordinary work. As you proceed, new conditions will arise in which the plane will be made to perform work under somewhat different circumstances than the ones we have been discussing, and when they do, I will show you how to use the tool in such a way that the conditions will be fully met; in the mean time we will take up some other matter."

"One of the first things you will require," continued Mr. Carpenter, "is a mitre box."

"Very well," said Fred, "if you will show me how to make one, I will commence at it at once."

"To make a good mitre box," said Mr. Carpenter, "you will require two sides made from inch stuff, five inches wide and two feet four inches long. Dress these up nicely, and guage them to an equal thickness and width. You see this gauge, it is figured in inches and eighths of an inch, the spur being on the first mark. The head is movable, and can be made fast at any point by the wooden thumb-screw. When you have made a straight edge, or planed one side of a piece of stuff true, you can set your gauge to the width or thickness required; then fasten the head in place, and press the head against the planed edge or side, and the spur will mark off the desired thickness or width."

"Now then," Mr. Carpenter continued, "you have got the two sides ready; now get a piece of stuff two feet four inches long, and four and a half inches wide, and one and a half inches thick. True it up, and make it square. This is for the bottom piece. Now nail the two sides on the bottom piece, keeping the ends all even. Now you have a box without ends or top; to make it into a mitre box, you must square across with the steel square I bought you, and the uses of which I will explain to you some other time. Mark with a knife, then take the exact distance across the box; meas-

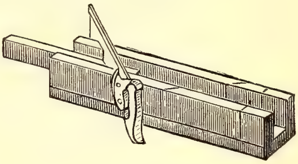


Fig. 22.

Fig. 22 shows how the saw kerfs may be cut if desired. Some workmen like this method, others like the one shown at Fig. 21.

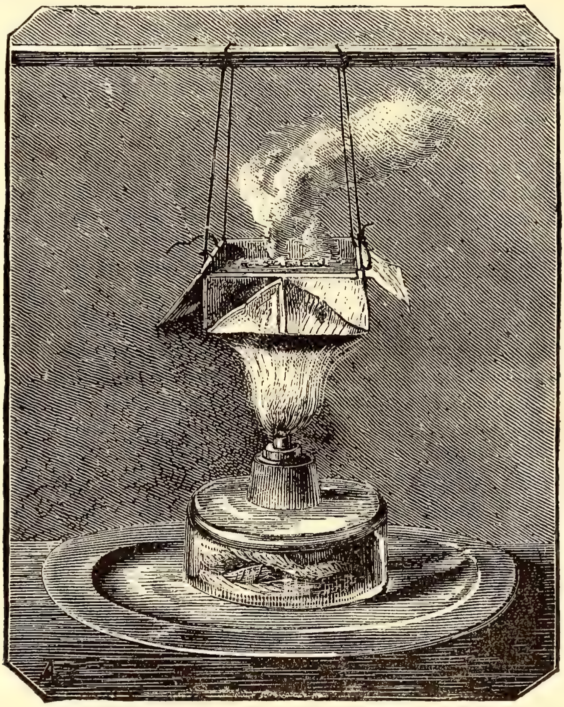
ure that distance on the side of the box from the line already made, then square across the box again. Now mark across the top of the box diagonally from point to point of the knife marks already made. These lines form a square mitre, or an angle of 45 degrees. Square down the sides of the box; now saw down until you strike the bottom of the box, minding to keep close to the lines, or the work will be but indifferently done. Now we have a mitre box that will do us a good deal of service. We can make it more useful by cutting a square cut in it at one end. This will do very well where we want to cut stuff square on end. The box can be used for many other purposes as I will show you as we proceed."

(To be continued.)

—To enlarge a hole in a glass plate, use a fine rat-tail file with a little turpentine and camphor. If the hole is nearly the size of the file, the latter will stick and break the glass plate, if it be turned round from left to right, but not if it be turned from right to left.

Science of Common Things.—Fire and Water.

FIRE and water have long been recognised antagonists, and, although water may be apparently made to burn, yet the general effect of water when thrown on burning bodies is to put out fire. This it does by cooling them below the point at which they burn, when, of course, the fire goes out. A very simple and interesting illustration of the reason



WATER BOILED IN A PAPER BOX.

why water quenches fire is shown in the accompanying engraving, where water is being boiled in a paper vessel. To perform the experiment, make a box out of stiff close-grained paper, by folding up the sides and ends and turning over the corners in a manner well known to children. Such a box when filled with water may be suspended by four threads from a horizontal rod, and if placed over a lamp, as shown in the figure, the water will soon boil. No fear need be entertained that the paper will burn; the water prevents

this completely. In our next, we shall tell of other methods of heating water in vessels which are not usually supposed to be capable of resisting fire.

Crystals Under the Microscope.

AMONGST the favorite objects of the early microscopists were crystals of different salts. Baker, in his book, "Employment for the Microscope," describes almost all the salts at that time known, and he even attempts to identify various plants by means of the different appearances of the crystals formed by the salts obtained by leaching their ashes. And even now, when the young microscopist has not succeeded in procuring a good "find" of microscopic plants or animals, a few of the more easily procured salts will furnish a great deal of pleasant and instructive amusement.

Crystals may be easily mounted for preservation and further examination, but it will be found that altogether the most interesting sight is the actual formation of the crystals under the eye of the observer. For this purpose a little nitre, sal ammoniac, or any other salt that crystalizes in needle-shaped or feathery crystals, gives the most beautiful results. A little of the salt having been dissolved in water, a drop is placed upon a well-cleaned slide (which has been slightly warmed) and spread evenly in a thin layer. No cover glass is used as we wish the liquid to evaporate quickly. The slide having been placed upon the stage of the microscope in a few seconds crystals are seen to form and shoot out over the entire surface of the field of view. The scene of minute forest growth cannot be described; it is too surprising and beautiful. Fortunately, however, the experiment is so easily tried that any one that has a microscope can see it for himself.

One word of caution may be necessary. In very cold weather the microscope should be warmed so that the moisture from the slide may not condense on the lenses of the microscope and dim them.

Some salts crystallize in very curious forms. Thus salicine takes the form of beautiful circles, with rays proceeding from the centre. The same is the case with the compound formed of iodine and sulphate of quinine, and when crystals of salicine or quinidine are viewed by polar-

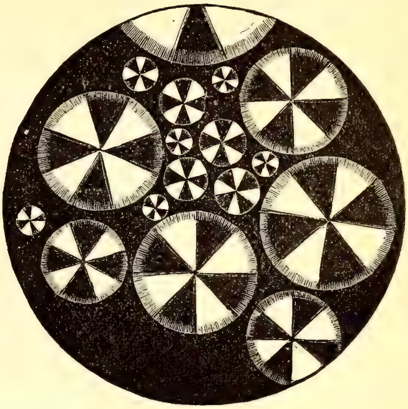


Fig. 1. CRYSTALS OF QUINIDINE SEEN BY POLARIZED LIGHT.

ized light, the sight is a most beautiful one. The entire field is seen to be filled with circles, each containing a little cross, which, as the polarizer turns, revolves like a little wind mill. When, in connection with the polarizer, a selenite plate

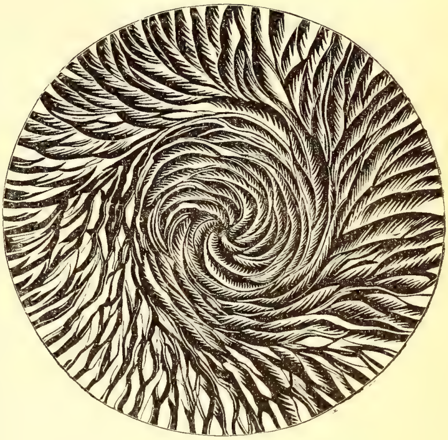


Fig. 2. SPIRAL CRYSTALS OF SULPHATE OF COPPER.

is used, the sight is one of the most beautiful that can be imagined. The little crosses shown in Fig. 1, instead of being black and white, are gorgeously colored with red and green, blue and yellow.

When pure solutions of salts are mixed

with gum or similar matter, they sometimes crystalize in very curious forms. Fig. 2, shows a form sometimes taken by sulphate of copper, under such circumstances. The reader will observe the curious spiral form assumed by the crystals, and it will be well to compare them with crystals formed by a pure solution of the same salt.

Mixtures of different salts also give rise to curious combinations of crystalline forms. Thus a mixture of sulphate of copper and sulphate of magnesia crystallizes in a manner that is both curious and beautiful.

Of all the crystallizations which can be readily produced, however, none equal in brilliancy and beauty that of pure silver. But to be seen in perfection the crystals must be watched during the process of formation; when mounted, even in their best condition, they fall far short of the appearance which they present while growing. The method which we have found to give the best results is to place a drop of solution of nitrate of silver on a slide, and bring in contact with it a small mass of the amalgam used for ordinary mirrors. The drop of liquid should be well spread out and the glass should be black. If black or dark colored glass cannot be procured, a piece of black paper may be pasted on the under side of an ordinary slide. As soon as the amalgam has been brought in contact with the solution of silver, decomposition takes place, nitrate of tin and mercury formed, and pure silver is thrown down. This pure silver instantly forms, with the other substances present, a minute voltaic battery and the rest of the silver is deposited in beautiful crystals just as copper is deposited on one of the poles of the Daniel's battery. These crystals shoot across the field with considerable rapidity, and they are seen to grow in exquisite fern-like masses, of which our engraving gives a faint representation. While fresh, their surfaces are clear and brilliant, and if well illuminated by means of the bulls-eye condenser, or any similar method of condensing light on them, they are almost dazzling. An objective and eye-piece of low power should be used, a magnifying power of thirty diameters being sufficient.

We prefer the amalgam of tin and mercury to all other agents for throwing down the silver, because it does not interfere with the beautiful white color of the crystals, as do copper and most other metals. When a greenish hue is desired, however,

Fig. 3. CRYSTALS OF SILVER.

copper or brass may be used. When the solution becomes weak, the crystals form in slender, needle-like stems; when the solution is strong, the silver is deposited in frond-like masses. By varying the strength of the solution during the process of crystallization, the most beautiful effects may be produced.

Home-made Telescopes and Microscopes.—XII.

ON THE OBSERVATIONS REQUISITE FOR CORRECTING OBJECT-GLASSES.

FOR this purpose, a particle of mercury is placed upon a slip of black glass. A piece of watch-spring, or the thin handle of a spatula, is held up at its end by the fore-finger of the left hand, and slapped down on the mercury, which is thus beaten into powder, in the form of numerous minute globules. Of these, a larger size is selected for correction of color, and a minute one for ascertaining the errors of figure and centering, and state of the oblique pencils.

The globule must be illuminated by direct candle or lamp light, and not by daylight, as the latter will not allow per-

fect correction to be obtained. The light requires to be set as close as it can be, and, of course, in the highest powers, where there is little distance in front, it must be very oblique; but this is of no consequence, as it is not the globule itself, but the spot of light reflected from it, that is required to be seen.

The lens to be tested is adapted to the microscope, having the ordinary Huyghenian eye-piece. On placing the globule either in or out of focus, the luminous point expands into a ring. If the object-glass is under-corrected for color, as in a single lens, the bright ring appears within the focus, the outer margin is red, and the inner circle green. If the lens is over-corrected, the bright ring appears *without* the focus, with the colors in the same order as before. A practical knowledge only, derived from these appearances, can determine the amount of concavity to be given to the flint, or difference of convexity in the crown, for obtaining the desired correction; but even in the most experienced hands it generally involves several alterations to secure perfect achromatism. When this is corrected as far as practicable, a pale-green color only is perceptible beyond the focus. This arises from the secondary spectrum, or relative difference in the width of the prismatic color spaces of the crown and flint, and seems to be a variable condition, according to the composition of the glass employed.

Though correction for spherical aberration is intimately related to that of color—a single lens when finally achromatised, being also nearly free from spherical error; yet, in a combination of three pair, when matched so as to be achromatic, this may be so considerable as to render the object-glass useless, and is oftentimes exceedingly troublesome to remedy. The error may arise from an improper proportion between the relative foci of the lenses—as the back being too long. I have before stated that, in the form that I have advocated, the spherical aberration is mainly corrected by giving thickness to the front lens, and by properly adjusting the distance between them. In a glass spherically under-corrected the light from the globule is greatest within the focus, and when set out of focus speedly vanishes and becomes diffused; in the case of spherical over-correction the contrary appearances result. When the relative distance of the lens is rightly adjusted, the light spot expands equally, and is of the same intensity, for a short distance on either side of the focus, in which the globule should appear with a clear bright margin. The object-glass is now in a proper condition for testing errors of construction and workmanship.

To examine the condition of the oblique pencils, and consequent flatness and distinctness throughout the field, a small globule is selected, and brought to the edge, using the lowest eye-piece; if the bright point in the centre of the globule, when a little out of focus, approaches to the inner side of the concentric light-rings, as in Fig. 20, it is termed "outward coma," and indicates that the front incident surface of the back triple is too *convex*. If, on the other hand, the bright spot is on the outer side of the rings, or next the margin of the field of view, there is "inward coma," which shows that this same surface is too flat. I have previously remarked that this curve has a powerful effect on the flatness of field and perfection of oblique pencils, and for these no other correction is generally requisite than an alteration in this radius.

Before the glasses are finally cemented in their cells, they should be carefully tested for centering; for this purpose a very minute globule is selected, and placed exactly in the centre of the field. If the bright spot appears eccentric, with the rings thus (Fig. 21), the pair of lenses which occasion the error should be shifted on each other while warm enough to cause the Canada balsam by which they are cemented together to yield, till on repeated trial the error is corrected. This is important, as the least fault of centering materially impairs the performance of an object-glass. But with the precautions that I have adopted in the construction, already explained, errors of centering cannot occur.

There is yet one other globule test for object-glasses, to indicate accuracy of

workmanship, or whether the lenses are worked to true spherical surfaces. If the rings from a minute globule appear of an irregular wavy outline, as shown by the annexed cut (Fig. 22), either approximating to a polygon or triangle, it shows that one of the surfaces at least that refracts

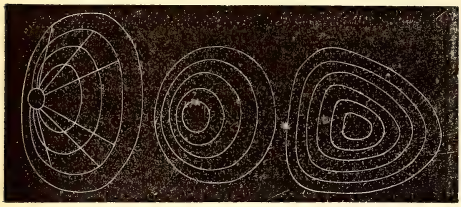


Fig. 20. Fig. 21. Fig, 22.

the rays is of this form. Such workmanship is inexcusable, and those that cannot avoid it had better let glass-grinding alone.

Finally, there is an appearance that I have sometimes seen in our best object-glasses, when focussed away from a globule, viz., "Newton's rings;" this shows that in the contact surfaces of one of the pair of lenses, the convex is deeper than the concave, and bears hard in the middle. This may have no worse effect than loss of light; but still it is as well avoided.

Gravitation Converted into Home Attraction.

BY A. W. ROBERTS.

WHAT shall we do to-night, little folks? Tell stories, or make something?"

"Oh make something! make something, Papa!" was the general reply.

"What shall it be?"

"Make a 'grunk man,' what the side-walk jumped up and made the bleed come, so that he had to sit down till the soger man came around and took him to his mother."

We all laughed at little "Dumps" request, which I promised to grant.

"Now, then, bring forth your 'trumpery' as Mamma calls it, and we will see if there is a sufficiency of uselessness to construct a drunken man out of."

Cast aside slate sponges, crooked sticks, tissue paper, beeswax, shells of English walnuts, some old water colors, a piece of lead pipe, two tumble bugs, and a "hoppy toad," which Ned informed me he had kept for three days hidden under the lounge, and I musn't tell Mamma nor Bridget. From these, was to come forth a terrible example of intemperance.

For a correct likeness of the drunken man the reader is referred to Fig. 1, which

Fig. 1.

was made in the following manner: The shells of an English walnut were fastened together with beeswax, after which a hole was bored through the smaller end to admit of a stick of wood, six inches long, and pointed at the end, which was then fastened in the hole with hot wax. Another piece of wood five inches long, the ends of which curved upwards was fastened to the first stick, two inches below the nut, with thread.

With plaster-of-Paris and a piece of lead pipe, I was to cause this forthcoming man to reel and tumble about, as if greatly demoralized.

Mixing the plaster to a thick paste, I placed a layer half an inch thick in a small bowl, well greased with lard to pre-

vent the plaster from sticking. When this was set, a flattened-out piece of the lead pipe was placed in the centre of the plaster. The bowl was then filled to the rim with more plaster, when the remaining end of the six inch stick was inserted in the centre of the plaster before it set, as shown by the dotted lines in Fig. 1. After the plaster had set, I withdrew it from the bowl, and while still moist, shaved down with a pocket knife the too conical end of the half sphere of plaster, taking care not to shave into the piece of lead. I then went over it with sandpaper. The ends of the cross stick were dipped into soft plaster, and when this had set, they were carved to resemble hands.

The nut, upright and cross sticks, formed a rude head, body and arms, which was dressed with tissue paper fastened together with boiled flour paste.

The walnut was then painted flesh color, the features were drawn in with writing-ink, and a ruddy complexion was given by vermilion.

The hair and beard were composed of the downy parts of chicken feathers stuck on with warm wax.

When all was finished, great was the astonishment of the children, over this image that couldn't lie down, but went reeling and rocking across the table, Little Dumps looked scared, and whispered " Are it a gunk man for truly ?"

I had no idea what industrious collectors little folks are till next evening, when I was brought face to face with a small sized mountain of " trumpery " that consisted of the loaned collections of all the children on the block. I learned that my glory as a toy maker had spread, and that my last night's effort had been on exhibition all day on the front stoop to an admiring crowd, and to the dismay of Bridget, who had to " clane up the clutter after thim."

Out of this miscellaneous gathering I constructed the monkey as shown in Fig. 2, which was composed principally of old sponge slate cleaners, and was a sort of irrepressible pen-wiper, which, the children christened the "Chimpansee," pen wiper, and declared it to be so pretty, when finished, that it must be placed on the nic-knackery stand.

It was made in the following manner: Selecting the largest size piece of sponge,

Fig. 2.

I cut it into the form of a monkey's body, clipping it smoothly with a pair of scissors. Then a head was made the same way, also a pair of arms and legs and tail. These different parts were then gone over with a red hot poker which charred the surface of the sponge, so that it was easy to shape the parts more perfectly by scraping the surface away with a knife. This application of heat also gave the sponge a rich brown color. The several parts were then fastened together by passing a double-threaded needle through them.

After the body was finished, the eyes and mouth were painted in. It was then fastened to a lead button. The button was cast in a mould of yellow soap, which was made by boring into it with a teaspoon. When the lead button came out of the mould it was ridged, and rough, till sandpapered off smooth, after which the bottom was ground flat; this was to cause the monkey to rebound quickly to the upright position. The latter was fastened to the body of the monkey with hot wax, after which it was varnished with black asphalt varnish.

The next article made was a magic bottle, shown in section in Fig. 3. Taking a piece of wood, I shaved it into the form of a bottle with a very long neck, this was then thoroughly oiled. After which strips of tissue paper moistened in water were wrapped compactly around the bottle, and between each wrapping boiled flour paste was applied thinly.

The neck part was formed by folding and pressing the wet tissue about the neck of the wooden shape, using plenty

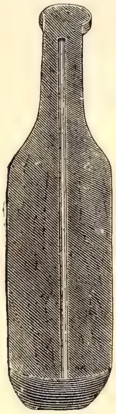


Fig. 3.

of paste to fasten the folds securely together. The paper wrapping was then dried and coated with black asphalt varnish. After the varnish was dry, the wooden shape was slipped out of its paper covering. A leaden button cast in a soap mould was closely fitted to the inside of the paper wrapping and fastened with hot wax, so as to form the bottom of the bottle.

This bottle presistently stood up, no matter how flatly it was laid down.

To cause it to lie down I used a small piece of iron, which I palmed in my hand,* and whenever I wished the bottle to lie down, I slipped the wire into it. To cause it to stand up, I dropped the wire into my hand, and palming it, I passed the bottle to the children. They, of course, failed to make it lie down, so that they were completely mystified. Sometimes I pretended to take a drink out of the bottle, and slipped the wire into my mouth, again passing it back when I wished the bottle to lie down. At last they gave it up, and I explained to them the action of gravitation, as I propose to do to the readers of the Young Scientist, in my next article.

* For an explanation of the method of "palming" objects, see "Lessons in Magic"—Young Scientist, vol. i, p. 139.

To Make a Magnet Out of a Poker.

At first sight this seems a wonderful feat, and yet, when we consider that we have always at hand the most powerful magnet of which we have any exact knowledge, it is not so surprising after all. The magnet to which we refer is *the earth*. Perhaps all our readers do not know that the earth is a magnet, but we can assure them that such is the case, and that it is solely by its magnetic force that all the magnetic needles in the world are made to point to the north. And it is further a fact that this great magnet, the earth, induces magnetism in every piece of iron lying on its surface. When a long piece of iron is placed in such a position that the poles are formed very close together, then the magnetism that is manifested is very weak, but when the poles are formed in the extreme ends of a long piece of iron, the magnetism is sometimes so strong that good sized nails may be lifted.

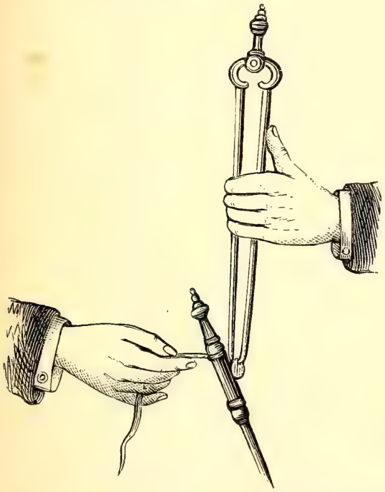
Now, for this purpose, the best position of the piece of iron is when the longest diameter lies parallel with the magnetic axis of the earth. The magnetic axis is not exactly the same as the astronomical axis, but it will be found that when a rod of iron stands so that it points to the north pole, it always gives pretty strong indications of magnetism. Even when held exactly perpendicular, a long iron rod becomes a powerful magnet, and hence, the iron tubes used for drive wells are always magnets. This is the true explanation of the notorious "magnetic wells."

If a poker be held upright and tested with a needle (a common charm compass will answer,) it will be found that one end repels, and the other attracts, each pole of the needle, thus showing that it is a

magnet, so that to redeem our promise to make a magnet out of a poker, all we have to do, is to tell our readers to hold it upright. But, unfortunately, the magnetism is weak, and as soft iron does not retain the magnetism which is imparted to it, as soon as we change the position of the poker, the magnetism is weakened to such a degree that we can hardly detect it. By the following method, however, we can easily make a permanent magnet out of a small piece of steel.

Such a piece of steel is easily procured; a piece of an old file answers very well, but a piece of well-worked steel which has been made as hard as possible, is neater and better. Having procured such a piece proceed as follows:

Take a poker and tongs, or two bars of iron, the larger and the older the better, and fixing the poker upright, hold to it with the left hand, near the top, by a silk thread, the bar of steel, of which the magnet is to be made, the marked end being downwards. Then, grasping the tongs with the right hand, a little below their middle as shown in the figure, and



MAKING A MAGNET WITH A POKER AND TONGS.

keeping them nearly in a vertical line, let the bar be rubbed with the lower end of the tongs, from the marked end of the bar to its upper end. about ten times on each side of it. By this means the bar will receive as much magnetism as will enable it to lift a small key at the marked end; and being suspended by its middle, or made to rest on a point, this end will turn to the *north*, and is called its *north* pole; the unmarked end being the *south* pole.

How to Hang a Thermometer.

THE recent cold weather has called general attention to this subject. The great differences in the readings of thermometers hung up a short distance from each other, show either that the majority of thermometers are incorrect, or that they have not been subjected to the same influences. In general, the temperature that we desire to get is that of the surrounding air. Too often, however, we get the temperature of the clear sky, or of some wall or building which is either much colder or much hotter than the air. The temperature of the wall of any building, at any hour of the night or day, is not the true temperature of the circulating air, and is of no use to science. A wooden wall becomes cold more rapidly than one of brick or stone, and the amateur scientist who hangs his thermometer on a wooden wall can force his mercury down below the amateur who selects a brick wall. The proper way to expose a thermometer is to surround it with a light wooden frame, covered with slats, like shutter work, and roofed over. This will protect it from the direct rays of the sun and reflected heat. Run a light bar of wood across the centre of your shelter, to which the thermometer may be attached. This should be on the north side of the building, and at least one foot from all surrounding objects.

The effect of a clear sky during a cold night in depressing the thermometer, is something extraordinary. A simple screen of cloth placed between the thermometer and the sky, though at some distance from the former, will make a difference of several degrees in the result. Fortunately the bright bulbs of ordinary thermometers do not radiate heat very rapidly, and so the effect of this influence is not felt as severely as it might otherwise be. But if we blacken the bulb so as to increase its radiating power, and then expose it to a clear sky, the fall will be something remarkable.

The fact that the bulb of the thermometer, in its usual bright condition, neither radiates or absorbs heat rapidly, is a most valuable and important one. It is best seen in the case of the rays of the sun falling quickly on the bulb. Ordinarily this makes a change of but a few degrees—15 to 30 at the most. But when the bulb is blackened, a difference of 100° to 150° may be seen between shaded and unshaded thermome-

ters! Some years ago we tested this very carefully, and found that while a thermometer, screened from the rays of the sun, showed but 9° above zero, a similar thermometer, with the bulb blackened and screened from draughts of air, showed 165°!!

A Lubricator for Whetstones.

A French journal suggests, as a substitute for oil in sharpening tools, a mixture of glycerine and alcohol. The proportions of the mixture vary according to the instrument operated on. An article with a large surface, a razor, for instance, sharpens best with a limpid liquid, as three parts of glycerine to one part of alcohol. For a graving tool, the cutting surface of which is very small, and the pressure exercised on the stone in sharpening very great, it is necessary to employ glycerine almost pure, with but two or three drops of alcohol.

A Brilliant Coating for Ornaments.

The appearance of articles manufactured by amateurs, and intended for mantel-piece and other ornaments, may often be greatly improved by coating them with the following preparation: Plates of mica are first rendered perfectly clean and white, either by boiling in muriatic acid or by igniting them; they are then washed, dried, and ground to a fine powder, which is thoroughly sifted and mixed with very thin collodion. In this condition it is applied, like paint or varnish, with a soft pencil, two or three more coats being given to the article until the desired thickness is obtained, which is determined, of course, by the taste and judgment of the workman. The objects thus coated have a silvery appearance, and possess the valuable advantage over those in which the ordinary metallic bronze is employed, of not being at all affected by sulphurous vapors; neither are they injured by dust or dirt, and are readily cleaned by washing in water. Collodion adheres firmly to glass, porcelain, wood, metal, and pasteboard; and as mica is capable of taking any desired color, at the same time retaining completely the lustrous appearance distinguishing it, it furnishes by this process an exquisite covering for a large variety of articles.

Doing Much.

Many persons seem always to be in a hurry, and yet never accomplish much; others never to be hurried, and yet do a great deal. If you have fifty letters to answer, don't waste time in looking over and pondering which one you will answer first; arrange them without much thought in the order of their importance, and then go through the whole pile. Some begin a thing, and have it partially completed, and hurry off to something else. A better plan is to complete whatever you undertake before you leave it, and be thorough in everything; it is the going back from one thing to another that wastes valuable time. Deliberate workers are those who accomplish the most work in a given time, and are less tired at the end of the day than many who have not accomplished half as much; the hurried worker has often to do his work twice over, and even then it is seldom done in the best manner, either as to the neatness or durability. It is the deliberate and measured expenditure of strength which invigorates the constitution and builds up the health; multitudes of firemen have found an early death, while the plow boy lives healthily and lives long, going down to his grave beyond three score and ten.

French Polishing.

This operation requires practice to ensure success, but is easily acquired. The surface of the wood should be thoroughly smooth, and the grain well filled. Rub down with finest sandpaper until of a uniform greyish tint, without scratches, and remove dust with a dry warm cloth. Make a wad of flannel or wadding; saturate this with French polish, and wrap in an old piece of printed cotton or soft rag. Touch the rag with two or three drops of raw linseed oil, and rub the work in a circular direction. Do not allow the rubber to stick. When the surface is well bodied in, finish off in the same manner, but with two-thirds polish to one-third alcohol. In other words, thin the polish in the rubber every time it is saturated, until the wood is as bright as plate glass. Twenty-four hours should elapse before the finishing process is commenced.

Working Hard Metals.

Metal workers know that some alloys are very hard to drill or turn in the lathe. So are phosphor bronzes, the aluminum bronzes, and even the alloy of 7 parts zinc, 4 of copper, and 1 of tin, with which a Paris mechanic lately experienced much difficulty. He remembered, however, that even hard glass may be cut with a good steel drill when it is lubricated with turpentine, and so he tried this on hard bronze with good success. The best material he found to be petroleum, mixed with turpentine spirits, with the help of which the tools, which otherwise soon became blunt, retained their cutting edges. He found that even hard steel, only slightly tempered to a straw-yellow, could be easily cut in this way with good chisels and drills made rather harder than usual.

Feeding Terrapins.

THE *Washington Globe* tells us that in one of the fish-ponds of the Smithsonian Institution at Washington, some twenty varieties of terrapin have been kept for purely scientific purposes. It was the custom to feed them on such interloping fish as disturbed the fish-cultural economy of other preserves. A low goldfish, a hybrid trout, a carp of impure race, would be thrown to the terrapins. Sometimes these fish were eaten, but mostly were haughtily disdained. One day this Spring, a gardener who had been cutting the blooming clover, filled his barrow with the fragrant load and trundled it over a plank. He made a misstep and dumped his clover into the terrapin pond. In an instant the water was in a commotion. Every terrapin, no matter whether from Long Island Sound or the Gulf of Mexico, was seen busy devouring the clover. Like Elia's roast pig, the secret of feeding terrapins was discovered. Learned and grave Smithsonian professors chuckled over it. During the past Summer the daily allowance for the Smithsonian terrapins has been a barrow-load of sweet clover. This hint may be of service to those who keep these animals as pets in aquaria or elsewhere.

Practical Hints.

Shop Counters may be cleaned by the use of the following mixture, which must be sparingly applied by means of a rubber of cotton: Linseed oil, 1 pint; alcohol, 4 ounces; acetic acid, 4 ounces; spirits turpentine, 4 ounces; muriate of antimony, 1 ounce.

Mucilage for Mineralogical Specimens.—This cement is described as invaluable for mending fossils and minerals, and for attaching labels to them, being very adhesive and never becoming brittle or scaling off. Starch, two parts; white sugar, eight; gum arabic, sixteen parts; water, sufficient. Dissolve the gum, add the sugar and starch, and boil until the starch becomes transparent.

Cement for Broken Delf or China.—The following cement dries rapidly, so that in two or three days the mended articles are quite firm, while with oil or varnish cements (such as white lead) weeks are required. Make a thick solution of gum arabic in water, then stir in plaster-of-Paris until the mixture becomes a sticky paste. Apply with a brush to the broken edges, and stick them together.

To Save Articles from Rats.—Rats are accomplished rope-walkers, and are able to make their way even along very small cords. Consequently, so long as they can mount upon the lines, nothing edible suspended therefrom is safe from their attacks. Perfect security may be attained by using wires, upon which circular pieces of tin are strung, the meat, grain etc., being hung between the tin pieces. The rats cannot pass the tin circles, because, as they attempt to climb over them after walking out on the wire, the pieces revolve.

Painting Gilt Paper.—We wished to paint, with water colors, a monogram on gilt paper, but could not get the paint to lie, not even when mixed with gum; it either scaled off, or was patchy. After trying various expedients, we scratched all over the surface of the monogram with a hard lead pencil, and we then found that the water colors could be easily painted on the surface. Their effect on the gold ground was very great, and perhaps some of our "illuminating" readers may thank us for illuminating them with this "wrinkle."—*Printers' Register.*

Lamps With Colored Flames.—It is said that glycerine may be burned in any lamp so long as the flame is kept on a level with the liquid. The latter, on account of its viscidity, will not ascend an elevated wick. As the flame, like that of alcohol, is almost colorless, and as the material is especially adapted for dissolving a large proportion of saline substances, M. Schering has recently made experiments in coloring the flame with various bodies, and with satisfactory results. By introducing substances rich in carbon, it appears that the flame may be rendered suitable for illuminating purposes.

Hot Sand as a Bed-Warmer.—The good effect of hot water or a hot brick when placed in bed with persons who are weak or sickly, is well known. A bottle of hot water is a general favorite, but something quite as good, and a great deal more pleasant, is a bag of hot sand. Get some clean, fine sand, dry it thoroughly in a kettle on the stove, make a bag about eight inches square of flannel, fill it with the dry sand, sew the opening carefully together, and cover the bag with cotton or linen cloth. This will prevent the sand from sifting out, and will also enable you to heat the bag quickly by placing it in the oven, or on the top of the stove. After once using this you will never again attempt to warm the feet or hands of a sick person with a bottle of hot water or a brick. The sand holds the heat a long time, and the bag can be tucked up to the back without hurting the invalid. It is a good plan to make two or three of the bags and keep them ready for use.

To Write Permanently on Glass.—The surface of the glass is gently heated over an alcohol lamp, or Bunsen gas-flame, until the vapor of water ceases to condense upon it, when it is to be coated with a varnish made by dissolving 8 grammes of sandarac and 4 grammes of mastic in 80 grammes of alcohol (95 per cent.) The solution is easily effected by heating the ingredients in a flask. It forms a varnish which is very hard, and ought to be completely transparent; if the surface over which it is poured is cold, it becomes opaque.

The glass surface coated in the manner described may now receive any design or sketch drawn upon it with ordinary ink or india-ink. It is then covered with a film of any non-alcoholic varnish.

This process may be advantageously employed as a substitute for the labels commonly used on bottles in the laboratory and elsewhere, to draw or trace sketches on glass for magic-lantern projections, etc

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business letters or cards they cannot be used.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

To exchange, an $8 Challenge self-inking printing press, chase 3 x 5 inch, for type or offers. Address, by sealed envelope, Wm. F. Hill, 666 Bergen St., Brooklyn, N. Y.

To exchange, a $60 Wardwell (2 spool) sewing machine, nearly new, also a $3.50 stylographic pen, for coins and books, or offers. C. C. Bulkley, 195 Sigourney St., Hartford, Conn.

Wanted back numbers of "American Naturalist" and "American Journal of Science and Arts" (Silliman's Journal), for beautiful specimens, named, of American ferns, mounted or unmounted. Box 16, Pine Plains, N. Y.

Wanted, to correspond with some one living near the ocean beach; also some one living near any lead or copper mines. Ewing McLean, Greencastle, Ind.

Beautiful Beryls, Garnets, Tourmalines, Rose Quartz, Muscovite, Granites in variety, etc., to exchange for coins, shells, fossils, minerals, books, magazines—anything. Describe offers fully. C. Le R. Wheeler, Wilmot, Merrimack Co., N. H.

To exchange for 1 new Vol. II, Young Scientist, 1 new Vol. I of ditto, and Prof. Bell's Lectures on the Telephone. F. H. Burger, Chester, Pa.

Wanted, specimens metallic ores; will give in exchange fossil shells, Vicksburg epoch, Tertiary period; state kinds of ore. Philip Crutcher, Warren Co., Vicksburg, Miss.

I have 2,000 foreign stamps that I would like to exchange for others. F. Cushing, P. O. Box 178, Wattsburg, Erie Co., Pa.

An Official Printing Press, must be in good order, and type to make a complete printing outfit; state what is wanted in exchange. W. E. Cushman, Hartford, Ct.

Minerals, birds eggs, shells, woods, stamps, nests, books, insects, etc., to exchange for coins, stamps, minerals, birds eggs, insects, and fossils; send for my lists. Frank F. Fletcher, St. Johnsbury, Vermont.

Wanted to exchange 1 copy of Instruction in Wood Engraving, or set of dozen prints, suitable for practice, for specimens of algæ or minerals. S. E. Fuller, 25 Bond St., New York.

Wanted, copy of book called Corner Cupboard, and other scientific books; state what is wanted in exchange. G. S. Griffin, Emporia, Kansas.

I have some stamps which I will trade against other stamps, or offers; please send list of stamps you have to exchange. J., 226 West 22d St., New York.

Mosses from Germany, Colorado, and Illinois, also plants, Phænogamous and Crytogamic, to exchange for other mosses, lichens, liverworth, or algæ, East and South. Prof. P. Fr. Shuelke, Box 128, Pekin, Ill.

Wanted, a household microscope, telescope, large lenses, well-mounted slides for the microscope, books on the microscope or entomology, in exchange for stuffed birds or minerals; describe offers, and state what is wanted in exchange. E. O. Tuttle, Hampden, Mass.

A large number of books, papers, and magazines, to exchange for type, printing material, or offers. J. T. Jackson, Box 48, Metuchen, N. J,

Minerals to exchange for other minerals; state what specimens you have for exchange. Samuel Wynne, Box 54, Phoenixville, Pa.

Will exchange, for printing outfit or shot gun, 6 years Nos. of Scientific American, with Supplement of 1876, 545 foreign and U. S. stamps, Art of Swimming, Instruction in Shorthand, and other books. W. A. Smith, West Randolph, Vt.

Insects and butterflies from China; state what is offered in exchange. Edward Laurent, 621 Marshall St., Philadelphia, Pa,

I have a four-legged and four-winged one-headed chicken, in alcohol, which I should like to exchange for a good breech-loading shot gun, or for standard scientific books. A. H., Box 500, Albion, Ohio.

Good Specimens of the 17 years' locust (17 year cicada), in exchange for any kind of insects, beetles, moths, or butterflies. Harry C. Beardslee, Painesville, Lake Co., Ohio.

Wanted, scientific books, minerals, fossils, and Indian relics, in exchange for minerals, fossils, coins, old Continental and Federal money over one hundred years old (very rare), foreign stamps, A. W. Baily, Box 712, Atlantic City, N. J.

Birds eggs, books, foreign stamps, a good hammock, and revolver, to exchange for birds eggs and works on birds. F. D. Brown, Gallupville, Schoharie Co., N. Y.

A magic lantern with eight slides, cost $5, and other things, to exchange for scientific books, chemicals, or chemical apparatus, etc. A Campbell, Box 31, Derrick City, McKean Co., Pa.

Idaho Mineral Specimens, for bound books on science, travels, history, biography, political, masonic, and others that are instructive. J. P. Clough, Junction, Lemhi Co., Idaho.

I have minerals (including fossils and dentrites), to exchange for minerals; also a papyrograph outfit, without press (worth $25), for offers. W. H. Eastman, Hyde Park, Mass.

Klose's celebrated "School for the Clarionet," new, $3; will exchange for telescope, microscope, piccolo, books, or offers. Rush Holbrook, Wonewoc, Juneau Co., Wis.

One or two handsomely mounted red deer heads, attractive ornaments for any dining-room or hall, for microscope, telescope, sporting implements, camping outfit, scientific books, or offers. R. B. Hough, Lowville, Lewis Co., N. Y.

Lower Silurian fossils from near the Falls of St. Anthony, Minn., for good microscopic material, etc. John Walker, 810 Ave. S., Minneapolis, Minn.

The Young Scientist

SCIENCE IS KNOWLEDGE. KNOWLEDGE IS POWER.

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Fresh Water Mussels for the Aquarium.

BY A. W. ROBERTS.

IN MOST works on fresh water aquaria, mussels, (bivalve molluscs), are spoken of as being of little use, and devoid of interest. Such has not been my experience, as I have found them to be very useful, very interesting and beautiful objects for the fresh water aquarium.

Fig. 1 (see next page) represents the *Unio radiatus*, one of the most highly colored of this very large genus of molluscs common in our lakes, and slow flowing rivers and streams. The shell of this unio is of a light green color, merging into a yellow. From the " beak " (the highest point of the shell), radiate streaks and dashes of a dark and intensely rich green.

Fig. 2 is the *Anadon fluviatilis*, the most common of all fresh water mussels in New York State. In color, it is a dark brown in the young specimens, and in the matured, almost black, with the shel s more or less decomposed by the action of water which causes an exposure of the pearly structure of the shell as shown in the illustration.

The white foot of the mussel is shown in the figure partly extended from the shell. With this foot it burrows into the sand and pushes itself about from place to place. After having burrowed, it opens its shells and extends its syphonal tubes for the purpose of breathing and feeding. If closely watched, a current of water may be seen passing down and out of the tubes, this current is produced by a fringe of tentacles that surround each tube, each tentacle being furnished with rapidly moving cilia, which cause the water to pass in and out of the syphonal tubes. These tentacles when examined under a microscope are very beautiful objects. In the figure the tubes are shown at the lower end of the mussel.

I have found mussels indispensible

where a tank of water has become charged with a sudden development of minute animal or vegetable life, causing the water to look cloudy. With the assistance of a few mussels the water can be restored

Fig. 1. UNIO RADIATUS.

to its original clearness in a few hours. It is these minute vegetable and animal organisms that constitute the natural food of the mussel. On very many occasions, in the months of July and August particularly, when the temperature of the water in my tanks was rapidly approaching 80°, causing immense and sudden developments of animal and plant life, I

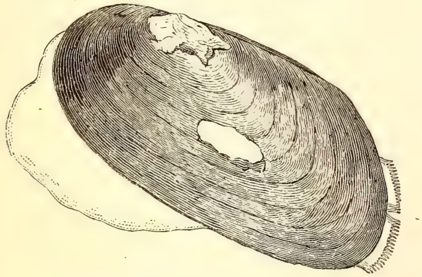


Fig. 2. ANADON FLUVIATILIS.

have used mussels with perfect success. Like the other animals confined in an aquarium, they must be watched, and that very closely, for if one should hide away and die and not be discovered it will be very apt to poison the water beyond recovery. A dead mussel can be known by his gaping shell; still, when doubtful, touch his shell near the syphons with a stick, and if he does not close up quickly, it is best to take him out and examine him carefully.

Thousands of these mussels are taken every year for the valuable pearl material, of which their shells are mainly composed, and which is worked into various articles by workers in pearl both in this country and Europe. Large quantities of these shells are shipped to England to be polished and mounted in gold and silver for ladies portemonnaies, which are again shipped to this country to be sold, they being in great demand by the fair sex, yet, if they were told that they were carrying in their pockets American clam shells, how quickly their admiration would cease.

It is not so many years ago since the inhabitants of New Jersey turned out *en masse* to dig mussels in the streams and ditches, for the pearls they yielded, many of which sold for high prices. I knew of some lumbermen from Maine, who, during their leisure hours, collected pearls from the mussels growing in the small streams and rivers near their camp. Some of these pearls were very beautiful both in shape and colors, being of blue and pink tints, for which they obtained high prices from our leading jewelers.

The rivers of Scotland, Ireland, Wales and Bavaria, abound in these pearl-bearing molluscs, and at the present day many fresh water pearls of value are being worn by the nobility of Europe.

Linnæus discovered by actual experiment that grains of sharp sand introduced between the valves of the shell in such a way that they rested between the body of the animal and the "Mother-of-pearl," or nacre, caused in a short time the deposition of a coating or crust of pearl on the sand grain, which, acting as a nucleus, gathered the shielding matter around it, and so guarded the delicate tissues, of the mollusc from friction and injury. It has also been found that by drilling a small hole through the outer coatings of the shell, and leaving the lining untouched by the boring instrument, that a pearl nodule was formed. This fact has been taken advantage of by the Chinese, who, introduce small images of their 'Josses' into the valves of the pearl oyster, which in course of time coats them with nacre.

Three Amateur Workers—and What They Did—VI.

BY FRED. T. HODGSON.

SEVERAL evenings after Fred had finished the mitre-box, Mr. Carpenter, Mrs. Carpenter, Jessie and the boys were sitting at the tea table, when Mrs. Carpenter asked Fred how he was getting along in the workshop.

"I think I am doing very well, Ma; at least Pa says I am, and you know he would not say so if I was not. I have made a mitre-box, and a work-bench, and two saw-horses, and I think I will soon be able to make you something nice; a flower stand or a cabinet, or some other equally good thing."

"I do not wish you to make anything for me yet, Fred. You must first make something for Jessie and Ellwood, and yourself. I can wait, and it will please me as well to see you make something for your brother and sister, as it will to have you make things for me."

"Oh yes!" said Ellwood, "I want Fred to make me a wagon or a sleigh, the first thing. Can't he, Ma?"

"Why, Ellwood," said Mr. Carpenter, "you know you had a wagon a short time ago. I think you can afford to wait a little while before getting another. Don't you think, Ellwood, that we all ought to give way like your Ma, and, instead of asking Fred to make anything for you or I, go to work and help him to make a little house for your sister Jessie?"

"Never mind me just yet," said Jessie, "I can wait until Ellwood gets his wagon."

"You are too kind, my dear," said her father. "I am sure Ellwood will be pleased to see you have a nice play house finished before he gets his wagon."

"Of course I will," said the boy, "I did not think about Jessie's house, or I wouldn't have mentioned about the wagon. Can't we go in the shop and start making the house to-night, Pa?"

"Yes," said Mr. Carpenter, "we will go in as soon as tea is over, but we cannot do much at it to-night, we can cut the stuff up, however, and make such preliminary arrangements as may be necessary. Before we can finish the house I will be compelled to buy some more tools for you; and now I think of it, I must also purchase a good scroll saw, one that can be driven by foot-power."

"Oh yes, Pa!" cried out Ellwood, "and get a saw with a turning lathe attached, that will be jolly, for then I can turn base ball clubs and other things."

"I don't think it will be wise to get a scroll saw with a lathe attached, Ellwood," said Mr. Carpenter. "All the tools I have purchased so far, are good, and capable of doing any kind of work within their range, and I think it will be better, when I do buy a lathe, to get one that will be in keeping with the tools already purchased. You cannot do any heavy work with those small lathes that are usually attached to saws; they will do small work very well, and many nice things can be made with them, but one of them would not suit us; I will get a good saw—one that will cut thick stuff as well as thin, and then it will answer all our purposes."

By this time tea was over, and the father and his two boys rose from the table and went direct to the workshop. Jessie would have gone too, but it was her usual custom—good girl as she was—to assist her mother and the servant, to put the dining room in order when tea was over. She soon followed her brothers into the shop, however, as she was just as anxious about her prospective play house, as any other little girl would be that was going to get one made.

When Jessie reached the shop, her father asked her how many rooms she would like to have in her play house.

"Well, Pa," she replied, "let me see. I think I would like to have a dining room, a parlor, a kitchen, pantry, and three or four bed rooms, a main hall down stairs, and a nice hall up stairs, and ——"

"Stop, my dear girl! stop!" said Mr. Carpenter, "you will give Fred a year's work if you continue. I think, if you get a play house with four rooms, and two halls in the main part, with a kitchen and pantry attached, it will be quite large enough for you. Don't you think so my pet?"

"Well, Pa, I will be satisfied with the number of rooms you say, but you will make the rooms large, won't you?"

"Yes," said her father, "we will make them a good size. We will have the parlor 18 inches long by 14 inches wide, and the dining room 12 inches by 18 inches, and two bed rooms in the second story the same size as the rooms down stairs. We will make the lower hall ten inches wide, and the upper hall the same width. The length of both halls will be the same as the length of rooms, eighteen inches. Now, if we imagine these lengths and widths to be in feet instead of inches, it would make the house appear to us to be a pretty large one. In fact, I intended that the house shall be built on the scale of one inch to the foot, or in other words, each inch on the play house, in any direction, will represent one foot of a real house—thus: the 18 inches which show the length of the parlor will represent 18 feet, thus showing the room to be 14 by 18 feet. We may consider the house we are about to erect as one-twelfth the actual size of a house whose dimensions are on the ground plan, eighteen feet by thirty-six feet. If you study this matter a little, you will understand why it is that architects and engineers make all their drawings to a scale."

The size of the house having been decided upon, it was determined to commence operations at once, so Fred chose out a number of boards, and under the directions of his father measured off the stuff.

For the sides he took boards ten inches wide, and cut them off 27 inches long. These were intended to stand on their ends, forming a wall 27 inches high by 18 inches wide. He planed and jointed this stuff, and then matched or tongued and groved the central joint with a pair of match planes* his father went out and bought, whilst he was cutting the stuff.

*Fig. 22 shows a pair of match planes in position for work. s s s s shows the several pieces of stuff tongued and groved. The planes are made in pairs, and the irons are nicely adjusted to match each other. They should never be used on stuff thicker than the width of the groving iron. Different thicknesses of stuff require different sizes of planes.

Fred then tried his hand at matching the side boards, and soon found that there was no difficulty in performing this operation. He finished this work and drove the boards together, then put them aside and began to cut up the stuff for the back, top, and two floors. He made the back 40 x 27 inches. This was two inches larger

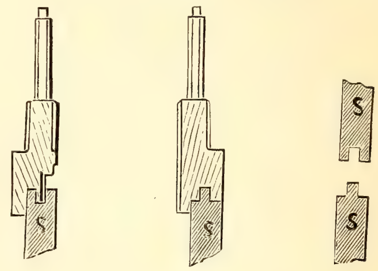


Fig. 22.

than the floors, as it had to be nailed to the sides. The floors were made 18 x 38 inches, and each floor was jointed and matched and cut square on the ends; they were intended to fit inside the sides, but the top, which was left two inches longer than the floors, was intended to nail right on the top of the sides; it was also one inch wider than the floors, because it had to be nailed on to the back.

The back, like the sides, floor and top, was made of narrow stuff jointed and matched. The two sides and two floors were cut to exact lengths as mentioned above, and made exactly eighteen inches wide.

All was now ready to nail together, but as it was getting late, this operation was postponed until another evening.

(To be continued.)

Home-made Telescopes and Microscopes.—XIII.

FORMULÆ FOR A QUARTER INCH AND ONE INCH OBJECTIVE, BY MR. SWIFT.

THE following is a very good formula for a quarter inch objective of eighty-five degrees of aperture, the radii of the curves being given:

1. Back triple combination. Curve of back surface of crown lens, ·525. Contact surface, ·225. Contact surface of lower crown lens, 1·500. Incident surface, ·59.

Working diameter of back crown, ·325. Incident crown working diameter, ·34. These lenses must be worked up to a sharp edge at the above diameters, for the purpose of getting the requisite thickness of the lenses, which, in all optical combinations of this description, is the only method by which it can be readily effected without the necessity of dismounting the lens from the lathe or stick on which it is ground, to gauge its thickness by means of a master-gauge. The finished diameter of these lenses is ·315. Thickness of edge of flint at this diameter, ·080. The middle combination of this objective is composed of two lenses—a double convex crown of ·225, of equal curves, and a plano-concave flint. These, as a matter of course, like the back combination, are cemented together. The working diameter of the crown lens is ·27, when worked to a sharp edge, as before described, the finished diameter being ·26. Thickness of edge of flint, when reduced to the finished diameter, must be ·070. The front glass is a plano-convex crown lens of ·115 radius, which is worked to a half sphere; its diameter, therefore, being equal to double its radius. The combinations of this objective, together with the front lens, are set in their cells against shoulders, which renders the setting or centering of the lenses, after a little practice, a very easy operation. The cell, carrying the front lens for convenience of adjustment, is best screwed to a piece of triblet-drawn tube, which can be made to fit over the cylindrical part to which the back and middle cells are screwed. By this contrivance, the proper point of adjustment on mercury can be readily obtained, by shortening the plain end of the tube fitting until the diffraction rings become equal on both sides of the focus of the objective. The curves of this objective are computed to suit a density of flint 3·9646, crown 2·540. This flint and crown glass is made by Messrs. Chance, of Birmingham, and can be obtained from various dealers,*

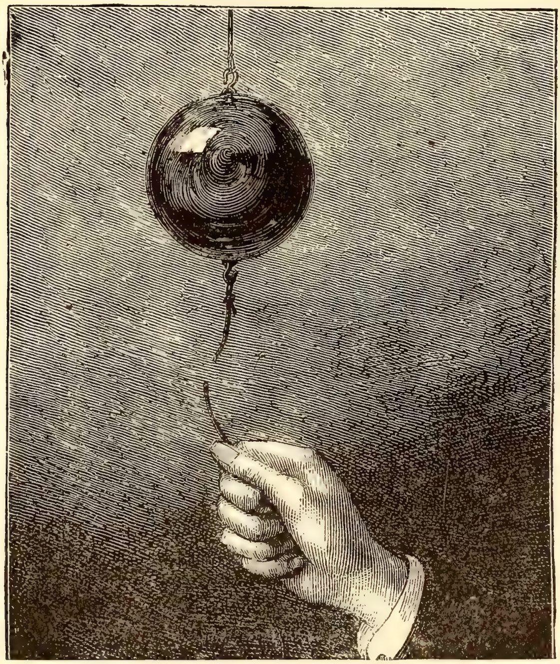
The posterior or back of the one-inch objective is composed of a triple combination. The front or anterior is a plano-convex crown lens and a meniscus flint. The curve of the back surface of the posterior crown lens is ·76. The curve of the next two surfaces is ·525. Contact surface of incident crown, 3·25. Incident or outside surface, 2·5. The back surface of the posterior crown should be worked 8-10ths of an inch in diameter, to insure accuracy of figure. Previous to grinding the contact surface of this lens, the diameter must be reduced to ·615, then worked to a sharp edge, which will give the thickness required for this lens. The working diameter of the incident plate is 9-10ths. This, as matter of course, will be ground to a sharp edge, as before described, for the purpose of getting the required thickness. The best method for an amateur to adopt would be to work the lens on a hard pitch pallet one inch or less in length. The lens is not so liable to tilt in working in the tool as it would be if the ordinary length of stick employed for this purpose were used, This method also applies to the shallow surface of the flint. Diameter of the posterior lenses when finished is 5-10ths; thickness of edge of flint at this diameter will be 1-10th of an inch. Back surface of anterior flint is ·41. Next two, or contact surfaces, ·21. Working diameter of front crown, 4-10ths. Finished diameter ·38. Thickness of anterior flint, at the finished diameter, measuring from back surface to front edge, ·125. Separation between the lenses is 7-10ths. Density of flint, 3·64. Density of crown, 2·540.

* The addresses of the principal dealers in optical goods and materials may be found in the "Microscopist's Annual."

Curious Experiment Illustrating Inertia.

THE experiment which we illustrate in the accompanying engraving, is a very remarkable one, and has the additional recommendation that it is very easily performed. Take a block of wood weighing ten to fifteen pounds, and suspend it by a piece of common cotton twine just as we have shown it. The block shown in the figure is a nicely turned ball, but this is not at all necessary; any kind of a block will do. To fasten the twine, you may use a couple of screw eyes, or even good

stout nails, but see that one piece of twine does not have the advantage of the other, owing to one of them being placed against a sharp edge or corner. If you now give a sudden jerk to the lower cord, you will find that it will break, while the upper cord, which apparently supports not only the force of the jerk, but the weight of the block, is not at all affected. Any person to whom the arrangement is shown before the cord is pulled, upon being asked "Which cord will break?" will almost certainly answer, "The upper one!" And great will be his astonishment when he sees that the block does not fall.



CURIOUS EXPERIMENT IN INERTIA.

The explanation of this singular experiment is very simple; if the jerk be sudden and strong, the under string gives way before there is time to transmit the motion to the ball, and consequently the force to the upper string. The inertia of the ball, therefore, saves the upper string from breaking. If, however, we pull the lower string *slowly*, the upper string will break, because it has to support not only the pull, but the weight of the block of wood. This is merely another illustration of a law which we may see in action around us constantly, and which is frequently taken advantage of to produce very strange results. Thus we would hardly suppose that a man lying flat on his back could bear the blows of a sledge hammer delivered by a strong man on his chest. But if we place a good heavy anvil on his chest, he will be able to bear the weight of the anvil and the blows too, if the latter are struck on the anvil. For the blow, which by its velocity would crush in the chest, is taken up by the anvil and rendered slow and harmless.

So, too, a leaden ball thrown from the hand will, if it strike a window, communicate its motion to the glass and shiver it to fragments. But if it be shot from a gun, so that its velocity is very great, it will not have time to transfer its motion to any more of the glass than just a space equal to its own size; this it will carry away, leaving a round hole.

Dangerous Toys.

POISONOUS confectionery and toilet articles have received a good deal of attention in this country, but thus far we know of no efforts to prevent the sale of poisonous toys.

A plentiful and cheap supply of toys will, it is generally considered, contribute to the happiness of children and the tranquility of their parents, but the recent action of the authorities in Paris suggests that this result may not always be insured. A toy producing the symptoms of lead poisoning is not so conducive to the diversion of children and the peace of their parents, as the Parisian itinerant vendor of these wares would have us believe. A number of boxes, filled with toys, painted in brilliant colors, elastic balls colored and varnished, soldiers in every variety of uniform, have been seized by the French police. It has been proved that the color would easily come off, particularly if the children put the toys to their mouths—a habit which seems inherent in every child's nature. "These playthings," says the *Lancet*, "painted with poisonous colors, had been imported from Furth, in Bavaria, and a committee of the manufacturers of that town has recently held a meeting on this subject. A circular was at once issued to all the toy manufacturers, urging them to use non-poisonous paints, and reminding them that according to the German law, they had exposed themselves to penalties—fines and imprisonment." The *Gesundheit*, of Frankfort, remarks that but for the repressive measures adopted in Paris, the German authorities would still neglect to enforce the German law. This apathy, according to the German papers, is all the more reprehensible, as the Furth manufacturers send their toys all over Germany, and may, therefore, poison the children of the Fatherland as well as the little Parisians—a consideration which, in the Teutonic mind, must greatly increase the gravity of the question. To us the matter is not less serious. It is well known that the majority—in fact, nearly all—of the cheap toys sold in the United States, are imported from Germany, and we regret that it is to the Parisians rather than to the United States authorities that we must attribute the honor of seizing these dangerous playthings. We trust that no time will be lost in following this excellent example, and that a more strict watch will be kept to prevent the importation from abroad of poison for the nursery.

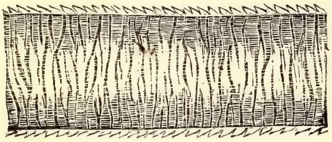
How a Hair Looks Under the Microscope.

EVERYBODY has heard of hairs as seen under the microscope, and this and "the animalcules in water," are generally the first objects that most people desire to see when the opportunity of looking through a microscope first presents itself. The popular ideas as to how a hair looks are very vague, and in many points erroneous, particularly those in regard to all hairs being *tubes*. This error has been repeated time and again in popular books, and yet, as we shall see, it has not a particle of foundation, so far as *human* hairs are concerned.

Nothing puzzles a beginner so much as the getting of a hair fixed under the microscope so that it can be well seen, and if you wish to test the skill of an amateur microscopist ask him to show you a hair. If he is very inexperienced he will lay it on the stage, and will find it impossible to arrange it under the objective. Or, perchance, he will lay it on a glass slide; it is then more easily adjusted, but the probability is that as soon as an attempt is made to look at it, the breath of the observer will blow it away. After this difficulty has been found two or three times, the young microscopist will probably cover the hair with a piece of thin glass. It is now easily managed, and can be very readily brought under the object-glass of the microscope, but the view is misty and very unsatisfactory. Unless he has a teacher, or has learned from books how to do it, this is as far as the beginner is likely to get. We will, therefore, tell our young readers how to manage a hair so that it can be seen clearly and well, and without any bother or trouble.

If you wish to get very good results, place the hair in a small phial of ether or

strong alcohol, and soak it until all grease and dirt have been removed. If you have no time for this, however, as when somebody plucks a hair and asks you to show it, simply wipe it and place it on the slide. If there should be no objection to doing so, cut off a piece of the hair, about half an inch long, and use that. Take a clean slide and place on it a drop of a mixture of equal parts of glycerine, alcohol and water, as described in the YOUNG SCIENTIST for December, 1879. In this drop place the hair; arrange it by means of a needle stuck in a small wooden handle, and when the hair has been thoroughly moistened and covered with the liquid, place a piece of thin glass over it. You can now place



HUMAN HAIR SEEN UNDER THE MICROSCOPE.

it under the microscope, when it will look just as we have shown it in the engraving. Across the body of the hair are seen many lines; these are the edges of the scales with which the hair is covered, and the saw-like notches are the edges of these scales seen in profile.

It will be noticed that along the centre of the hair there is a light streak; it was this which gave rise to the idea that hairs were tubular. It will be found, however, that a solid wire presents the same appearance, so that the light streak is due to the round form of the hair, and not to its being hollow. This is proved more fully by cutting the hair square across, and looking at it endwise. In regard to the best methods of doing this we shall have something to say in a future article.

Cheap Lathes and How to Use Them.—II.

CHOICE OF A LATHE.

WE at first intended to address ourselves wholly to those who were already in possession of a turning lathe, but since the publication of our first article on the subject, we have received so many requests for advice in regard to the purchase of this tool, that we feel obliged to say something in regard to the choice of a lathe.

Lathes can be obtained at almost any price, from $3 up to $1,500. The cheapest lathes are those little things attached to scroll saws. In these lathes, poor as they generally are, a turner who is really expert can make some very pretty and very useful articles. We say *really* expert, because it is not every man that can turn out fine work that is really expert. In many cases the lathe itself does nearly all the work, being self-acting and furnished with all necessary means and appliances. On such a lathe the merest bungler can do good work. But to take a weak, shaky, untrue lathe, and by skilful manipulation to bring forth something presentable, that shows true skill. Many of our readers, no doubt, own such lathes; hereafter we will tell them how to remedy their defects and avoid the errors which these defects are likely to introduce, but in giving advice in regard to the *choice* of a lathe, we would say avoid them. A beginner should, if possible, procure a good tool, for he will need its aid to produce respectable work, and besides he will find difficulties and defects enough in himself without having to worry over those of his lathe.

At prices ranging from $15 to $25 very excellent lathes may now be had. These lathes are all metal; the workmanship is excellent, and the material is of the best. If the lowest of these figures is beyond the reach of the reader, he must content himself with one of those lathes which have only metal heads on wooden "shears" or "bed," as this part is sometimes called. At one time wooden shears were very common, even in the best lathes, and some of the old tools, with mahogany beds, were capable of doing very accurate work. But since the planing machine, and other tools driven by steam power, enable us to work iron almost as easily as wood was formerly worked, wood has been abandoned as a material for lathes except in the very cheapest kinds. Therefore, when only a very cheap lathe is within the reach of the reader, he will probably select one

made largely of wood. There is not much room for choice amongst lathes of this kind.

When the intending purchaser is not confined to the *cheapest* form of lathe, the first question that will arise is as to the size that should be procured. At first sight it would seem that the larger the better—within reasonable limits. For since small objects can be turned on a large lathe, while large objects cannot be turned on a small lathe, it would seem that all the advantage was on the side of the large lathe, and to get two, a large and a small, would be to imitate the man who had two holes made in his barn door—a large one for the old cat and a small one for the little kittens, forgetting that a very small kitten can go through a very large hole.

A lathe that is too small is a constant source of annoyance where the owner desires to do general work. Of course if the lathe is intended for some special department, such as turning the fittings of small optical apparatus, such as microscope objectives, etc., the case is different, but this is not a frequent case.

There are two directions in which the size of a lathe is measured; the first is the diameter of the object which it is capable of turning, and the other is the length of the article which it can take in. Some lathes are made capable of taking in work of very large diameter, while the beds being very short, they are fitted for turning up wheels, pulleys, and such articles, but not for anything that is long. Other lathes are made exactly the reverse of this, being fitted for turning articles of great length but small diameter. The amateur, however, unless he has some special work in view, should select a well-proportioned lathe, and we think that one capable of taking in articles eight to nine inches in diameter, and three feet long, is about as good a size as can be chosen. When we say eight or nine inches in diameter, we mean, of course, over the bed, and not over the rest, for it will scarcely happen that the amateur will have to turn an object nine inches in diameter and three feet long, though he may often have to turn objects three feet long, and others that are nine inches in diameter.

When articles of greater length or diameter are to be turned, it will often happen that the young workman can, by a little contrivance, devise means for performing the work. Thus, in our own practice, we have often managed to build up a temporary bed, on which the tail-stock might be placed, and in this way we have succeeded in turning up simple work of considerable length. And on the other hand, by turning the head-stock round so that the face-plate would hang over the left-hand end of the shears, and by rigging up a temporary support for the tool rest, we have succeeded in turning up articles of considerable diameter on a very moderate-sized lathe.

Of course these make-shifts will not do for intricate work, or for turning metal or heavy pieces of hard wood, but they answer very well for light and simple objects.

Having decided upon the size and price, the next thing to be done is to examine the various lathes in market, so as to select the best that comes within the limits of the points we have mentioned. Each part of the lathe under inspection should be carefully examined, and directions for doing this will be given in our next article.

BOOK NOTICES.

Practical Hints on the Selection and Use of the Microscope: Intended for the Use of Beginners. By John Phin, Editor of the *American Journal of Microscopy* and the *Young Scientist.* Third Edition. Thoroughly Revised and Greatly Enlarged. With Six Full Page Plates and Seventy-six Figures in the Text. Price 75 cents. New York: Industrial Publication Co.

This work has been out of print for some time, as the publishers were unwilling to send the old plates to press without thorough correction. The work of revision has been more extensive than was anticipated, and has occupied considerable time, but the advance sheets of the work are now on our desk, and the complete volume will be accessible to our readers before many days pass by.

The book we leave to other hands for criticism. That it has numerous faults we are fully aware, and we know that these have not been entirely eliminated. Fully one half the book has, however, been entirely rewritten, and the whole has been extended to 240 pages, instead of the 181 of the former edition. The kind reception accorded to the first and second editions leads the author to hope that the present one will not be entirely unacceptable to our young friends who are interested in microscopy.

Nickeling Small Articles.

Many unsuccessful attempts have been made to nickel small articles by boiling, just as pins, hooks and eyes, etc., are silvered or tinned. Dr. Kayser is said to have succeeded in coating metals with an alloy resembling German silver, thus giving them a handsome finish, and making the surface more durable and permanent than that of tin or silver. He first melts together 1 part copper and 5 parts pure tin—preferably the Australian, which has recently come into commerce, almost absolutely pure, yet cheaper than Banca tin. The alloy is granulated as usual, but not too fine, and then mixed with water and tartar, as free from lime as possible, into paste. To each 200 parts of the granulated alloy is added 1 part ignited oxide of nickel, and the articles are laid in it. After boiling a short time they become beautifully silvered. Some fresh oxide of nickel must, of course, be added from time to time. Brass and copper articles can easily be silvered in this manner without previous preparation; those of iron must first be copper plated. By adding some carbonate of nickel to the above bath, or to a common white bath, and boiling, a coating richer in nickel is obtained, and darker, varying in color from that of platinum to a blue black, according to the amount of nickel salt added.

To Render Plaster Casts Water-Proof.

Mr. R. Jacobsen gives the following method for preparing gypsum moulds so that they will permit being washed. A neutral soap of stearic acid and caustic soda is prepared and dissolved in about ten times its weight of hot water. The moulds or objects are either coated with, or immersed in this solution. By this procedure the color of the object is not affected, it is rendered impervious to moisture, and permits the object to be washed, even with lukewarm soap water, since stearate of potassium is only soluble in hot water. Soap water is entirely superfluous for washing gypsum casts; warm water is all that is requisite. Ordinarily, moulds, etc., are cleaned of dust and dirt by means of soap water. This removes the dirt, but leaves, in its place, a film of soap, which most readily collects and retains dust. This same difficulty is presented by gypsum that has been impregnated with a solution of alum and stearine. A coating made with a solution of stearate of alumina in benzole behaves in a similar manner. The gypsum can also be made impermeable to water by saturating it with a solution of oleic acid in benzine; this should be but slightly colored and oxidized. This solution is to be applied to the object when cold, and in such quantity as to completely saturate the gypsum. These objects are not to be cleaned with soap water, since this would take up the oleic acid, but should be wiped with a cloth, moistened with the acid. The first described method gives the best results, and is especially to be recommended in voluminous castings.—*D. Ind. Zeitung, ix*, 82.

Microscopic Lead-Trees.

A writer in the *English Mechanic* says: "To make the above, place some good-sized pieces of gum arabic in a saucer, and then pour in acetate of lead until they are half immersed. In about twelve hours some of them will have a clear drop of thick gum on the top. Put some of this on a slide on which zinc has been filed with a fine file, and instantly place over it a glass cover. If the slide is at once placed under the microscope, the trees may be seen growing, but slides that are intended for the box should be kept under pressure until dry. They will not require cementing or papering, the gum being quite sufficient for the purpose. I discovered this method about ten years since, and find the slides I then made to be in perfect preservation. The finer the zinc particles and the weaker the acetate solution, the finer will be the trees, and *vice versa*."

Patina on Zinc.

Patina is a term applied to the coating which the natural corrosion of the elements produce on metals. A solution of molybdic acid or of molybdate of ammonia in weak *aqua-regia*, or a solution of molybdic acid in an excess of strongly diluted soda lye, furnishes, according to M. de Kletzinsky, a very good bath with which to obtain a patina on objects cast in zinc. The objects are simply immersed in a bath, when they shortly acquire a brownish patina, very agreeable to the sight, and having a characteristic iridescence. The effect here described is due to the formation of a thin film of oxide of molybdenum, which develops the colors of polarization, and which adheres strongly to the zinc.

Crystallized Wood and Paper.

According to Professor Boettger, the simplest method of giving paper and wood surfaces a crystalline coating is as follows: Mix a very concentrated cold solution of salt with dextrine, and lay the thinnest possible coating of the fluid on the surface to be covered, by means of a broad soft brush. After drying, the surface has a beautiful bright mother-of-pearl coating, which, in consequence of the dextrine, adheres firmly to paper and wood. The coating may be

made adhesive to glass by doing it over with an alcoholic shellac solution.

Professor Boettger mentions the following salts as adapted to produce the most beautiful crystalline coating: sulphate of magnesia, acetate of soda, and sulphate of tin. Paper must first be sized, otherwise it will absorb the fluid, and prevent the formation of crystals on its surface. Visiting cards with a mother-of-pearl coating have for some time been in use. Colored glass is well adapted for such a coating, which has a good effect when the light shines through.

Practical Hints.

Mistakes of Letter Writers.—The following are some of the reasons why a letter does not go:

Because you forget to address it.

Because you forget to stamp it.

Because you forget to write the town or State on the envelope.

Because you used a once cancelled stamp.

Because you cut out an envelope stamp and pasted it on your letter.

Because you used a foreign stamp.

Because you wrote the address on the top of the envelope, and it was obliterated by the post office dating, receiving, and canceling stamps.

And because you put your letter in a blank envelope, and sealed it and forwarded it to—the Dead Letter Office, where thousands upon thousands of valuable letters are daily destroyed because the people are either careless or ignorant of the postal laws.

And to the above we would add a few reasons why an answer don't come:

Because you do not sign your name.

Because you sign it so indistinctly it cannot be read.

Because you do not give name of post office.

Because you do not give name of State.

Because you write with a pencil, which is rubbed off and illegible.

Because you use ink so pale and dim it cannot be read.

Because you write so poorly no one can read it.

Because you do not enclase stamp to prepay postage on the answer.—*Saturday Night* (*Cincinnati*).

To Soften Hard Putty.—A correspondent of *The Garden* says: After many trials, and with a variety of differently-shaped tools, with various success, I at last accomplished my end by the simple application of heat. My first experiment was with a soldering iron, when, to my great delight, I found the putty became so soft that the broken glass could be removed by the fingers and the putty be easily scraped away. All that is required is a block of iron about two and a half inches long by one and a half inches square, flat at the bottom, and drawn out to a handle, with a wooden end like a soldering iron. When hot (not red) place this iron against the putty or flat on the broken glass, if any, and pass it slowly round the sides of the square. The heat will so soften the putty that it will come away from the wood without difficulty. Some of it may be so hard as to require a second application of the hot iron.

A New Mode of Treating Burns.—The removal of infiltration of the skin is easily accomplished, according to M. Ungerer, by osmose. He had occasion to prove this lately in having to treat an extensive scald on the hand, which resulted in a large and exceedingly painful swelling without wounds. Cold water treatment for 12 hours did not relieve the swelling in the least, and the pain was almost unbearable when the hand was removed from the water only a few seconds. He, therefore, made a diffusion experiment, dipping the hand in a saturated salt solution, and the success was surprising. Though the salt solution had not the temperature of the ice water, the pain diminished almost immediately, and in four hours blister and pain were both entirely gone. The hand next day differed from the other only by a very slight swelling and redness.

Inlaying.—Inlaid wood is held in place by the tightness and completeness with which the inlaid parts are mortised into the main body or bed of the wood. They are also held in by pins or pegs when the pieces are large and the hold given by the sides of the mortise is insufficient. When thick slices, or masses of ivory or metal, or even thin metal are used, as in Boulle work, the metal should have the help of small pins at intervals. But the chief agent in connecting surfaces of wood to slices of ivory, bone, horn or thin shell is glue, which, when good and properly applied, holds with a degree of strength that is sufficient on almost any requirement.

Moire Metallique.—The following is given as a method of crystallizing tin plate. Heat the plate till the tin begins to melt, and dip it into a solution of 1 part of bichromate of potassa in 3 parts of water, 2 parts of muriatic acid and 1 part of nitric acid. After rinsing well, muriatic acid is poured over the tin plate, and then a solution of 10 parts hyposulphite of soda in 120 parts of water. The crystalline flowers produced hereby display a great variety of colors, according to the time of contact. Rinse well with water, then with alcohol, and lastly lacquer.

Pocket Mucilage.—Boil one pound of the best white glue and strain very clear; boil also four ounces of isinglass, and mix the two together; place them on a water-bath with half a pound of white sugar, and evaporate till the liquid is quite thick, when it is to be poured into moulds, cut, and dried to carry in the pocket. This mucilage immediately dissolves in water, and fastens paper very firmly.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business letters or cards they cannot be used.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, whe we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

To exchange, fine imported game fowls of the best strain for Fleetwood scroll saw, compound microscope, telescope, magic lantern, shot gun, or offers. E. Alexander, Johnstown, Fulton Co., N. Y. Box 47.

Wanted, scientific books, minerals fossils and Indian relics, in exchange for minerals, fossils Indian relics, shells, etc.; send for lists; correspondence in German and English. A. W. Baily, Box 712, Atlantic City, N. J.

J. T. Bell, Franklin, Pa., has set of ivory chessmen, German flute, six extra keys, value $12, books, etc., to exchange for magic lantern, music box, guns, revolvers, or offers.

Birds eggs and arrow-heads to exchange for fossils and minerals, and birds eggs; send for my list. Clement G. Burns, Salem, Col. Co., Ohio.

Minerals (zeolites, etc.), to exchange for other minerals; state what specimens you have to exchange. H. L. Clapp, 35 West Cottage St., Roxbury, Mass.

Cabinet mineral specimens of Idaho in exchange for books, minerals, curiosities, etc., etc.; send for list and state what you have to exchange. P. Clough, Junction, Lemhe Co., Idaho.

Type, in exchange for curiosities, fossils, etc. Geo. K. Fischer, 729 North 6th St., Philadelphia, Pa.

I have some stamps which I would like to trade for stuffed birds, birds eggs and nests; I am also open to an offer; send for list of stamps. A. G. G., Box 26, Summit, New Jersey.

U. S. and foreign postage and revenue stamps for others; U. S. match and medicine especially; send list or sheet and I will do the same. B M. Hammond, cor. Elm and Live Oak Sts., Dallas, Texas.

Wanted, a hand or self-inking printing press, small size, in exchange for books, magazines, papers, etc. B. D. Howell, High Bridge, Hunterdon, Co., N. J.

Demas lathe sea shells, rubber boots, California woods, YOUNG SCIENTIST and paper shells, for stencil dies, boxing gloves, revolver, foils, book on navigation, and manly arts. A. W. Port, San Diego, Cal.

To exchange, an $8 Challenge self-inking printing press, chase 3 x 5 inch, for type or offers. Address, by sealed envelope, Wm. F. Hill, 666 Bergen St., Brooklyn, N. Y.

To exchange, a $60 Wardwell (2 spool) sewing machine, nearly new, also a $3.50 stylographic pen, for coins and books, or offers. C. C. Bulkley, 195 Sigourney St., Hartford, Conn.

Wanted, to correspond with some one living near the ocean beach also some one living near any lead or copper mines. Ewing McLean, Greencastle, Ind.

To exchange for 1 new Vol. II, Young Scientist, 1 new Vol. I of ditto, and Prof. Bell's Lectures on the Telephone. F. H. Burger, Chester, Pa.

I have 2.000 foreign stamps that I would like to exchange for others. F. Cushing, P. O. Box 178, Wattsburg, Erie Co., Pa.

Wanted back numbers of "American Naturalist" and "American Journal of Science and Arts" (Silliman's Journal), for beautiful specimens, named, of American ferns, mounted or unmounted. Box 16, Pine Plains, N. Y.

An Official Printing Press, must be in good order, and type to make a complete printing outfit; state what is wanted in exchange. W. E. Cushman, Hartford, Ct.

Minerals, birds eggs, shells, woods, stamps, nests, books, insects, etc., to exchange for coins, stamps, minerals, birds eggs, insects, and fossils; send for my lists. Frank F. Fletcher, St. Johnsbury, Vermont.

Wanted to exchange 1 copy of Instruction in Wood Engraving, or set of dozen prints, suitable for practice, for specimens of algæ or minerals. S. E. Fuller, 25 Bond St., New York.

Wanted, copy of book called Corner Cupboard, and other scientific books; state what is wanted in exchange. G. S. Griffin, Emporia, Kansas.

Mosses from Germany, Colorado, and Illinois, also plants, Phænogamous and Crytogamic, to exchange for other mosses, lichens, liverworth, or algæ, East and South. Prof. P. Fr. Shuelke, Box 128, Pekin, Ill.

Wanted, a household microscope, telescope, large lenses, well-mounted slides for the microscope, books on the microscope or entomology, in exchange for stuffed birds or minerals; describe offers, and state what is wanted in exchange. E. O. Tuttle, Hampden, Mass.

A large number of books, papers, and magazines, to exchange for type, printing material, or offers. J. T. Jackson, Box 48, Metuchen, N. J,

Minerals to exchange for other minerals; state what specimens you have for exchange. Samuel Wynne, Box 54, Phoenixville, Pa.

Will exchange, for printing outfit or shot gun, 6 years Nos. of Scientific American, with Supplement of 1876, 545 foreign and U. S. stamps, Art of Swimming, Instruction in Shorthand, and other books. W. A. Smith, West Randolph, Vt.

Insects and butterflies from China; state what is offered in exchange. Edward Laurent, 621 Marshall St., Philadelphia, Pa,

Good Specimens of the 17 years' locust (17 year cicada), in exchange for any kind of insects, beetles, moths, or butterflies. Harry C. Beardslee, Painesville, Lake Co., Ohio.

Birds eggs, books, foreign stamps, a good hammock, and revolver, to exchange for birds eggs and works on birds. F. D. Brown, Gallupville, Schoharie Co., N. Y.

A magic lantern with eight slides, cost $5, and other things, to exchange for scientific books, chemicals, or chemical apparatus, etc. A Campbell, Box 31, Derrick City, McKean Co., Pa.

Idaho Mineral Specimens, for bound books on science, travels, history, biography, political, masonic, and others that are instructive. J. P. Clough, Junction, Lemhi Co., Idaho.

I have minerals (including fossils and dentrites), to exchange for minerals; also a papyrograph outfit, without press (worth $25), for offers. W. H. Eastman, Hyde Park, Mass.

Klose's celebrated "School for the Clarionet," new, $3; will exchange for telescope, microscope, piccolo, books, or offers. Rush Holbrook, Wonewoe, Juneau Co., Wis.

One or two handsomely mounted red deer heads, attractive ornaments for any dining-room or hall, for microscope, telescope, sporting implements, camping outfit, scientific books, or offers. R. B. Hough, Lowville, Lewis Co., N. Y.

Lower Silurian fossils from near the Falls of St. Anthony, Minn., for good microscopic material, etc. John Walker, 810 Ave. S., Minneapolis, Minn.

The Young Scientist

SCIENCE IS KNOWLEDGE. KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

Vol. IV. NEW YORK, MARCH, 1881. No. 3.

Great Workmen and Their Tools.

WE called attention in the first number of the Young Scientist, to what might be done by "makeshift" apparatus, and during the past few months, under the title of "Science in Common Things," we have tried to show how very important truths might be illustrated by very simple appliances. The illustrations of these articles were first published in the French journal, *La Nature*, and they have been copied into several periodicals. But though we have borrowed the *illustrations*, the articles which accompany them in the Young Scientist are all original, and have been written specially with a view to the tastes and wants of our own readers.

But while advocating so strongly the use of very simple apparatus for the purpose of *illustrating* scientific truth, we must caution our readers against applying the same rule when they want to find out any of the great truths of nature. Great men, entering for the first time upon some special line of investigation, have made the most wonderful discoveries by means of the most simple tools. Thus, Ferguson, by means of a thread and a few small beads, was enabled to make a map of the stars; and his wooden clock, constructed out of coarse materials by means of a penknife, was certainly a wonderful performance. But his map was, after all, a poor affair compared with those that are now in use; and his wooden clock would hardly have served to run railway trains by. On the other hand, Newton, by means of a prism, a lens, and a dark room, unfolded the composition of light and the origin of color; Black's famous discovery of latent heat was made with a few thermometers and a pan of water; and Watt's first model of the condensing steam-engine was made out of an old anatomist's syringe, used for injecting bodies previous to dissection. But these are not safe examples for imitation. New-

ton, Black, and Watt performed wonders by very simple means; but it took a Newton, a Black and a Watt to do it. The truth is, that, when we get beyond the first elementary experiments, we cannot rely upon any but the most perfectly constructed instruments. Modern chemical analysis demands the use of balances, weights, and measures that cannot be extemporized even by ingenious mechanics; the spectroscope, the microscope, and the telescope of modern times are so perfect and have been so generally applied, that a person working with such a telescope as that with which Galileo discovered the moons of Jupiter, would stand but a poor chance of gleaning anything worth notice. The journals devoted to popular scientific articles are full of articles telling how this, that, and the other great man accomplished wonders with very simple tools. Thus, there is an anecdote told of the famous Dr. Wollaston, to the effect that a foreign *savant* having called upon him and expressed a desire to see his laboratory, in which science had been enriched by so many important discoveries, the doctor took him into a little studio, and, pointing to an old tea-tray on the table, containing a few watch-glasses, test-papers, a small balance, and a blowpipe, said, "There is all the laboratory I have." It is not at all improbable that the story is true; but, at the same time, we know well enough that Wollaston's laboratories were not only extensive, but filled with large and costly apparatus. His antipathy to display, and his love of privacy, no doubt led him to use the above subterfuge in order to avoid the rudeness of a positive refusal.

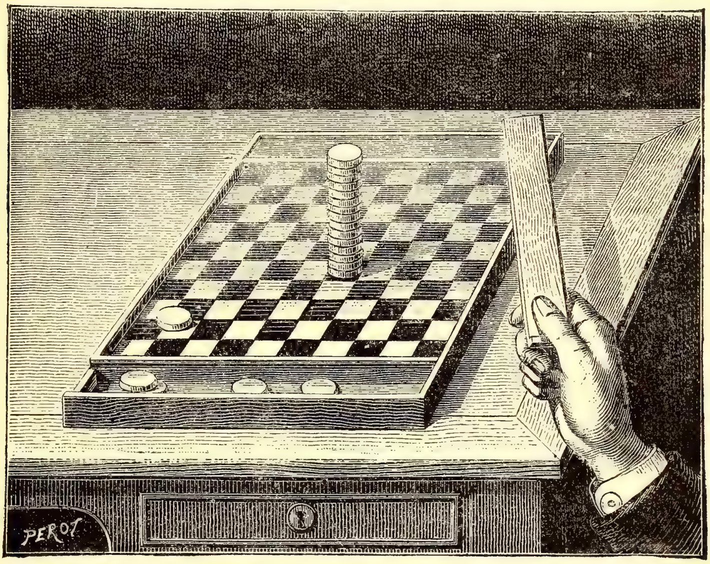
As an offset to this story, we may be allowed to relate two other anecdotes, both quite as well authenticated as the one we have just related. During his investigations into the properties of platinum, he tried furnace after furnace, in the hope of finding one that would produce veritable fusion in the metal. To such an extent did these and kindred pieces of apparatus accumulate, that the room in which the work was done soon became literally filled, and the few visitors that were admitted had to thread a very intricate path which meandered between the huge piles standing on either side. The story runs, that one gentleman, having laid down his hat in one of the bypaths leading from the main avenue, was never afterwards able to find his way back to it, and so lost it.

The second story is as follows: A gentleman, having on one occasion failed to make himself heard by knocking in the outer vestibule, boldly entered the sanctum, where wonder after wonder met his eye. One furnace in particular attracted his attention; and, while he was earnestly gazing at it, Wollaston approached. The philosopher was in a towering passion at having his privacy so rudely broken in upon; so, tapping the intruder upon the shoulder, he asked him if he had taken a good look at the furnace upon which his attention was riveted; "For," said Wollaston, "it is the last look you shall ever take at it," and he unceremoniously turned him out of doors. The truth is, that many of Wollaston's researches were entirely beyond the reach of such a laboratory as could be placed on a tea-tray; and we strongly suspect that the story first related had its origin in the fact that Wollaston was very fond of working upon minute quantities. In Davy's "Chemical Philosophy" will be found engravings of a set of microscopic apparatus, much of which was devised by Wollaston, and very successfully used by him. Faraday, in his "Chemical Manipulation," gives us the following anecdote illustrative of this: There existed in the British Museum a small fragment of a black stone, the source and history of which were unknown. It was unique—no other specimen being known to exist—and Mr. Hatchett, working with a quantity which weighed not more than two hundred grains, was enabled to prove the existence of a new metal, which he named Columbium. Ekeberg afterwards discovered what he supposed to be a new metal, which he named Tantalium; but Dr. Wollaston, having examined it and compared it with Hatchett's account of Columbium, suspected the identity of the two, and was able to prove this identity though he had not more than five grains of the stone

from the British Museum to work upon! But these facts are not inconsistent with the other fact that Wollaston owned and used large quantities of very powerful apparatus. The great point in Wollaston's methods, and that which the student ought to try to imitate, is the proper adaptation of means to ends.

Science of Common Things—Inertia.

NOTHING serves so well to explain any great law as numerous illustrations of it under varying conditions. We therefore give our readers another experiment, which illustrates the same principle as that involved in the experiment with the wooden ball, detailed in our last number. We have here a pile of draughts, and the problem is to knock out one of the lower ones without disturbing the rest of the pile. It is easily done by striking one of the draughts a sharp blow with some thin strip of wood, ivory, or metal. A table knife answers very well—the stroke being given with the back and not with the edge. The special point in regard to which care is to be exercised, is that the stroke be quick and level. If we merely push one of the draughts, the pile will topple over. If the stroke should be at all upward, the upper draughts will be raised and knocked about. The experiment may be varied by placing a card on the tip of the finger and a quarter dollar on the card. A smart blow on the edge of the card will drive it from beneath the coin, and leave the latter poised on the end of the finger.



EXPERIMENT ON INERTIA.

A Strategic Wasp.

NOT long since, while reading beneath the shade of a fig tree, our attention was attracted by a peculiar loud and shrill buzzing sound, as of some one of the bee family in distress. Looking in the direction of the noise, we observed quite close to us a dirtdauber, or builder, one of the species of wasps so well known for the cylindrical cases of mud it builds under eaves and on sheltered walls, which it stuffs full of certain worms and spiders for its young. This wasp had half of its body and head down the hole of the equally well-known doodlebug, a worm which children pull out of their holes by teasing them with a straw until they grasp it with their strong nippers, and

hold on until they are thrown out. It was evident, at a glance, that the wasp had gone down the hole of the doodlebug, and that the doodlebug soon had him in his strong grip at great disadvantage, and where the wings of the wasp were of no advantage to him except to make a noise, which might alarm his adversary. The contest lasted full two minutes, when finally the dirtdauber came out with a jerk. He flew but a few inches from the hole, lit upon the ground, rubbed his head, and fairly danced with pain.

In a few moments he recovered from the effects of his wounds, and began making short circles over the hole, evidently reconnoitering and laying his plans. Presently, lighting at the mouth of the hole, he tried the earth all about the entrance with the skill of an engineer, and, selecting that which was driest, he began to scratch like a dog with his fore feet, throwing the dust rapidly backward into the hole. We watched with intense interest, and could not but admire his pluck and determination, for we imagined this throwing of dust on his adversary's head was only to provoke him to a fresh fight. Every now and then he would stop and take a cautious peep down the hole to observe the effect of his operations. We expected every moment to see him descend and make another attack, but it soon became manifest that such was not his intention, and it gradually dawned upon us that he had a strategic mode of attack based upon the soundest principles of philosophy, reason, and a thorough knowledge of his adversary, and of the means he was using to render his resistance futile and make him an easy captive.

By throwing fine dust into the hole the doodlebug would soon be smothered, as it was necessary that he should have free air, unless he climbed upward, as he would do. Whenever the worm worked upward to get his head above, the fine dust fell behind him, and thus slowly closed up his hole, until, blinded with dust, he poked his head out at the top. This was the point aimed at, and the moment he showed his head above, the wasp pounced upon him, seized him by the neck, drew him up, gathered him in his arms, and flew off in triumph, though the worm was much the largest of the two. Struck with amazement at the sagacity, science, skill and engineering ability of the dirtdauber, we carefully sounded the hole, and found that in the course of five minutes this reasoning insect had filled in five inches of dust, and put his formidable adversary completely at his mercy.

The most skilful engineers could not have thrown up earthworks with a profounder calculation than this natural engineer.—*New Orleans Co-operative News.*

A Fine Cabinet for Nothing.

BY C. LE R. WHEELER.

MANY persons who are interested in Natural History are deterred from attempting to make a collection of specimens to illustrate and help forward their studies, for the reason that they deem it too expensive. My purpose in writing this article is to prove that a genuine interest, a resolute will, and untiring labor, will secure for any person a fine collection to illustrate at least some of the branches of Natural History at a very slight expense; and in some cases, my own for example, at *no expense whatever.*

In the summer of 1876 I returned from the West, bringing with me about seventy-five specimens of minerals. One of the first things that I noticed, upon coming to this place, was a beautiful piece of iron quartz lying in a minister's study. Upon inquiry, I found that it came from a quarry near by. I visited this quarry and others in the vicinity, and found large quantities of rose, greasy, smoky, and white quartz, orthoclase and graphic granite, and many interesting forms of gneiss, granite, and syenite. I began collecting and exchanging at once. One of my first exchanges was with the late Rev. E. Seymour, of New York. I next arranged to send several tons of minerals and rocks to the large Natural History establishment of Prof. H. A. Ward, of Rochester, N. Y. In exchange, I received all that I had expended in cash, and mostly the entire academic set of minerals described in Prof. Ward's catalogue, and I have nearly all of his fine set of rocks

yet to come. Then a sample copy of the Young Scientist reached me, offering an exchange advertisement free to all subscribers. I was satisfied that the tasteful little monthly was well worth the subscription price, and at once subscribed and sent in an advertisement. I soon began to receive letters from all parts of the world offering exchanges, and then found occupation for my leisure hours in packing up specimens and taking care of the packages that came to me by mail, express, and freight from a dozen different States and Territories. The result of this little advertisement has been to add *over two hundred* beautiful minerals, fossils, shells, Indian relics, and coins to my collection. In addition to this, several correspondents, who had more money than duplicates, asked me to sell them minerals; and upon comparing what I have expended for postage, freight, and all other expenses with what I have received in cash, I find that my receipts for minerals sold, have been a trifle more than enough to cover the entire expenses that I have incurred—thus actually giving me "a fine cabinet for nothing."

Three Amateur Workers—and What They Did—VII.

BY FRED. T. HODGSON.

JESSIE watched the erection of dolly's house with great delight, and, it being near completion, she was planning how to furnish it.

"Don't you think, Mamma," she said, one evening, when her and her mother were alone, "I can begin now to make the things for my house? I want to have it just lovely, you know, and it will take lots of time."

"Yes, my dear; I have been expecting you to ask to begin before this. I am glad my little girl has been so patient, and to reward you, Jessie, we will begin to-night."

Jessie was delighted, and ran off to the barn to communicate the good news to Fred and Ellwood.

They did not receive the news with as much enthusiasm as she thought it deserved, they were so engrosed with their own undertakings. So she soon returned.

"Mamma, Fred is going to make some lovely little cornices, with the scroll saw Papa bought, and don't you think we ought to make the curtains first, so that we can put them right up when the cornices are finished?"

"No, Jessie," said Mrs. Carpenter; "I think we will make and lay the carpets first in all the rooms. And then the next thing to do will be to upholster the furniture, which, you know, your Papa and Fred are going to make; it will be ready by that time."

"Yes, Mamma," said Jessie; "I want to furnish it just the same as if it was a big house for real live people to live in."

"Well, then, run out to the barn, and ask Fred to give you the exact measurement of each of the floors."

While Jessie was gone, Mrs. Carpenter brought out sundry bundles and parcels from what Jessie called the pieces drawer, and selecting some pieces of bright-colored plush and carpet, put the rest back, and awaited Jessie's return.

"Here, Mamma," said Jessie, coming into the room with a piece of paper in her hand, "Fred measured the parlor, and Ellwood measured the other rooms, and Papa says they are all right."

"Now, Jessie," said Mrs. Carpenter, "we will make the carpets for the chambers first, out of these small pieces of carpet, and reserve the larger pieces for the other rooms. These pieces are not very large, but if they are sewed together nicely they will answer the purpose very well. Now we will lay them out on the table, and arrange them so that a large cluster of flowers will come as near to the centre as possible. Sew those two pieces together, and I will sew the other two; try and match the pattern nicely and the seam will hardly be noticed, and then we will have one long seam down the centre, and when that is done we will measure and cut it the right size."

"Jessie," said Mrs. Carpenter, as they sewed and chatted together, "In what color shall we upholster the furniture?"

"Well, Mamma, I think red or pink would be nice, don't you?"

"Yes, I think a pale shade of pink

would be very pretty; but as one room is to be used for dolly's servant, it must have something not quite so delicate, and red would be too flaring. We must have all things to harmonize to make our undertaking successful as a work of art and good taste. The selecting of colors and combining them gracefully together is a work of art in itself. Can't you suggest some other color beside red or pink that would combine well with the drab ground of your carpet?"

Jessie could think of no other color, so Mrs. Carpenter proposed crimson or wine color."

"Oh, I think crimson would be lovely," said Jessie.

"Well, then, we will use crimson, and after we have made all the carpets, we will upholster the furniture for this room first," responded Mrs. Carpenter.

Mr. Carpenter. Fred, and Ellwood coming in just then, put a stop to more sewing, as they all agreed to stop at the same time.

After the boys had told their mamma and Jessie how much work they had accomplished, with many expressions about squaring, gauging, beveling and dovetailing, which Mrs. Carpenter or Jessie did not pretend to understand, Jessie produced her carpet; it was pronounced by all to be the very ideal of a carpet. Jessie made some inquiries about the cornices that Fred was going to make for her, and then retired to dream of dolls' houses, carpets, and crimson furniture.

On the following night the two boys, aided by their father, and closely watched by Jessie, began to put the house together, which was found, after all, to be not very much of a job. The sides, floors, and back were all nailed in position, but, indeed, at this stage, the structure had but a slight resemblance to a house.

The next thing to be done was to put a roof on, and to accomplish this a bevel was necessary; but, as usual, Mr. Carpenter had provided for this emergency by purchasing one the day previous. Fig. 23 shows what it is like. The slot in the blade is to permit of the blade to be lengthened or shortened at will. When adjusted to any required bevel, the thumb screw can be turned tight, which will hold the blade where placed until the work is done.

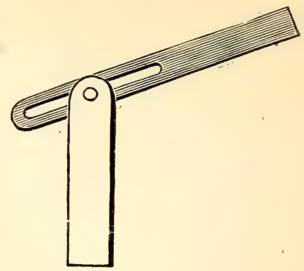


Fig. 23.

Fig. 24 shows a "try-square," two of which Mr. Carpenter bought when he

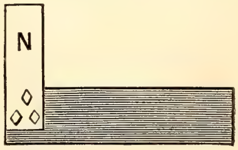


Fig. 24.

purchased the bevel. One had a blade six inches long, and the other ten. The stock, N, is made of rosewood or some other equally hard substance. There will be ample opportunity yet to show the uses of these tools and many others.

(To be continued.)

Management of the Aquarium.

FROGS, TOADS, NEWTS, ETC.

FROGS, toads, newts and salamanders differ entirely in their habits from the turtles, in their being at no period of their existence aquatic, and at other times semi-aquatic, or living part of the time on land and part in water. I can select no better account of the changes they undergo than that given by Professor Quatrefages:

"The development of frogs presents another curious phenomenon; it is this: The young of the animal, after it has left the egg, and before it has become a larva, is still in a semi-embryonic condition. At this period the digestive tube and its appendages are exceedingly rudimentary. The greater portion of the body is filled with a large mass of yolk or vitellus, en-

closed by the skin, which has been formed for some time; and it is at the expense of this alimentary matter that development proceeds. The external characters are in keeping with the imperfect condition of the animal at this period. The head is large, and appears to be divided in two on the under surface, each half being prolonged as a sort of process by which the animal attaches itself to surrounding objects; as yet there are no traces of either eyes, nostrils, respiratory or auditory organs; and the belly, of an oblong form, is continued posteriorly as a short tail, bordered with a riband-like membrane. About the fourth day after birth, the head, which is now as long as the body, has somewhat the appearance of a thimble; the mouth is provided with a pair of soft lips; the nostrils, eyes, and auditory apparatus have made their appearance; the head is separated by a deep groove from the belly, which has assumed a spherical form, and from which spring a pair of opercula, clothed with little branching gills. And the tail has grown so much that it is now quite as large as the body. The mouth is very soon armed with a horny beak, capable of dividing the vegetable food. The intestine, which is now very large, becomes more fully formed, and assumes a spiral arrangement. The tail is elongated and widened, and the little creature is then called a *tadpole*. At this period, one of those alterations occurs which are so intimately associated with the ideas we are endeavoring to convey, that we must not pass them by in silence. Our larva first breathed by its skin alone, and afterwards by a pair of little branching gills attached to the opercula. About the seventh or eighth day the opercula are gradually soldered to the abdomen, and the gills fade away and disappear. At the same time a set of new and more complex branchia are developed in the chambers situate on either side of the neck. The new gills are arranged in tufts attached to a solid framework of four cartilaginous arches, and are about one hundred and twelve in number for each side of the body. Before the tadpole can become a frog, it must do away with these second gills and replace them by lungs; and at the necessary time a set of changes takes place analogous to those we have described. The vascular tufts are atrophied, and the lungs, which till now were solid and rudimentary, open up and increase in size. The circulatory organs are correspondingly modified. The calibre of the large bronchial organs is diminished, and the pulmonary trunks increase in number and diameter. Later on the solid parts of the branchial apparatus disappear also, the bones and cartilages being gradually absorbed. Eventually the alteration is fully accomplished, and there remains not the slightest trace of the former branchial apparatus. In this instance, not only has there been transformation and substitution, but an actual metamorphosis has occurred; for the respiration, which was aquatic before, has become atmospheric, and, strictly speaking, the animal from having been a fish has been converted into a batrachian. If we examine any particular apparatus, we shall find it presenting many curious phenomena in the course of its development. We shall find that as the herbivorous habits give place to carnivorous ones, the digestive apparatus undergoes a change adapting it to the new form of diet. The mouth increases in size and gape; the little beak organs, or, more correctly, the horny lips, are replaced by teeth. The tadpole at first exhibits no trace of either external or internal limbs. It swims about like a fish by the action of its tail, which is an extensive organ, longer and wider than the body, supported by a prolongation of the vertebral column, moved by powerful muscles, and supplied with large blood-vessels and numerous nervous branches. Beneath the skin and muscles of the anterior and posterior regions of the body, two little projections appear at a certain period. These are the limbs, and are at first attached to the adjacent structures by the nerves and blood-vessels which are supplied to them. These projections increase in size, their appendages appear in due course, and eventually the hip and shoulder bones are developed. As soon as these locomotive organs enter upon the discharge of their functions, the tail begins to disappear. Its skin, mus-

cles, nerves, bones, and blood-vessels atrophy, and vanish from our sight. They have not faded away; they have not simply fallen off; they have not been cast off by a species of moulting, as in the case of insect larvæ. They have been got rid of by none of these methods; their substance has been reabsorbed, atom by atom, and hence, although it has ceased to exist, it is not the less alive on that account.

We see, then, that frogs undergo complete metamorphosis, not only in regard to their entire organism, but as to each set of apparatus, with the exception of the nervous system."

Frogs generally spawn about the middle of April, at which time they become very musical.

The ova or eggs of frogs consist of small round opaque bodies, enclosed in a jelly-like substance. This jelly-like substance is for the purpose of protecting the egg from its natural enemies as well as to afford support during incubation. The egg or embryo, consisting of a small globular body, darker on one side than the other, begins to show development within twenty-four hours, the black globes lengthen out, and in forty-eight hours the head and tail are well defined; the fin around the tail now appears, and from each side of the neck the lungs or branchiæ begin to start. In about two weeks' time after the eggs were deposited, the "tads" having absorbed a large portion of the jelly-like coating, break through, and become free. Their lungs now attain their full development, but in course of time disappear, being drawn into a cavity, where they are covered by a fold of the skin resembling the gill cover of a fish. The tadpole now grows very rapidly, feeding constantly on confervæ and decaying vegetable matter.

In the course of a few weeks small projections begin to appear towards the fore and back part of the body; these are the legs just beginning to develope, and, as they grow larger each day, the "tad" begins to learn the use of them, frequenting very shallow water, and rising constantly to the surface to breathe, for by this time the gill covers have closed up, and in place of them he now has perfect lungs and breathes free air through his nostrils. He is still in full possession of his broad fleshy tail, which seems to be greatly in his way, and is all that is left to remind one of his former tadpole condition; but in course of time this is gradually absorbed, till nothing is left of it but just the tip end. He now seeks the shore, and beeomes carnivorous.

The tadpole having become a frog is "small but pleasing to the eye," and is an excellent subject for an aquarium. Frogs raised in an aquarium are always to be preferred, as they are more domesticated, will feed from the hand, and are less liable to wander away. When domesticated, they are very partial to "croton bugs" and roaches, but will not take dead food, though I once had a very large frog which fed on raw beef, but the pieces of beef had to be kept in motion so as to cause him to think they were possessed of life.

Iron Floating on Water.

WE have all heard of the wonderful miracle, by which the Prophet Elisha caused the iron head of an axe to float on the water of the river Jordan. And the floating of iron ships is something with which we are all familiar, either from having heard of it, or from having seen it. A tin or iron cup or basin will readily float, provided it displaces an amount of water greater in weight than the weight of the metal in the vessel. But even a solid rod of iron may be made to float provided it is small enough. Take a fine needle, wipe it with an oily rag, but do not leave any visible trace of oil on it, and then lay it gently on the surface of water in a basin; it will float, and continue to float for some little time. The cause of this is the fact that a quantity of air adheres to the needle sufficient to buoy it up. Moreover, as the cohesion between the particles of water is considerable, and as water has no attraction for a perfectly dry piece of steel, the cohesion of the water is greater than the weight of the metal; and so the latter is supported.

In the same way insects are enabled to walk upon the water. The hairs on the

ends of their feet enclose an amount of air which enables them to float. As each foot is put down it forms a sort of cup-like depression in the water, and the

INSECT WALKING ON WATER.

liquid thus displaced is sufficient to float the insect.

Our young readers will have no difficulty in making the iron wire or needle float on a basin of water, and the experiment is a most astonishing one to those who see it for the first time.

Webb's Celestial Objects for Common Telescopes.

OUR readers will be glad to learn that the new edition of this work, which has been so long out of print, is nearly ready for delivery. The author has revised it with great care, and has added very considerably to the amount of matter which it formerly contained.

Any comments at our hands on this well-known book are unnecessary. It is just the manual for every amateur astronomer, whether he owns a telescope or not. To those who possess a telescope, or who intend to purchase one, the book is simply indispensable. So fully are we impressed with the value of this book, that we have arranged for a special edition, and are thus enabled to offer it at a considerably lower price than it would otherwise command.

We have the advance sheets now before us, and expect the complete work in a few days. The price will be $3, for which sum the book will be sent to any address in the United States or Canada.

New Copying Process.

Mr. Adler has communicated to the Photographic Society of Vienna a new copying process, based upon the use of the glue glycerin pad, which is employed in the hectograph. For the purpose of the new process, however, the pad must contain more glue. The writing or drawing is made upon paper with a concentrated solution of alum, to which a few drops of aniline ink are added, to make the letters or figures visible on the paper. Before transferring this to the pad, the latter is wiped with a damp sponge, and the moisture is allowed to remain a few minutes to make the surface sufficiently absorbent. The paper is now placed on the pad, written side down, and, after a few minutes, again removed, when the writing or drawing will be transferred to the pad. By means of a rubber roller a small amount of printer's ink is now applied to the surface; the ink will adhere only to the lines made by the alum solution. A slightly damp sheet of paper is now placed upon it, and, by gentle rubbing, the writing transferred to the latter. It is necessary to ink the pad each time, but a large number of impressions may be taken, and the prints have the advantage of being permanent and black.—*Pharm. Centralh.*, No. 49.

Preparation of Bone for Turning.

Leg or marrow bones are best: get them and saw off both knuckle ends or joints; with a hooked wire draw the marrow out, put them on the fire in a boiler or saucepan, with some water, and subject them to a simmering heat, which is far better than galloping them out of the pot. After two hours stewing, put by in the liquor until cold, then take them out, dry well in sawdust, and transfer to some powdered quicklime. In a few days they will be fit for use, and may be cut up into rings or strips.* Keep them in the lime until wanted; thus you will have bone equal in appearance to best ivory.

Horse bones are best; ox, sheep, and other animals do for smaller work, but generally I go to the shops that dress cow-heel or neats-feet, and tripe, and get the finest bones for general purposes.—*English Mechanic.*

The Relative Cost of Motive Power.

M. Bissinger, M. E., at Carlsruhe, Germany, gives the following results as obtained in his examinations of the several motors in regard to the relative cost per horse for each hour. It will be observed that the examination pertained principally to small motors. The relative cost per effective horse-power per hour is as follows:

100-horse power steam engine	7.6
2-horse power steam engine	44.3
2-horse power Lehmann's caloric engine	26.5
2-horse power Hock's motor	40.0
2-horse power Otto gas engine	26.4
2-horse power Otto Lang gas engine	26.4
2-horse power Schmidt's hydraulic motor, supplied with water from the city water works	95.00
2-horse power obtained by horses and a gin	45.00
2-horse power obtained by manual labor	200.00

Otto's gas motor and Lehmann's caloric engine are the cheapest of the small motors, but are, nevertheless, four times as expensive as the 100-horse power steam engine.

A Monocular Muse.

BY MARY H. WHEELER.

A Rotifer, deep in an eddy-swept pool,
By the leaf-shaded shore of a rivulet cool,

Contentedly lived in her own minute style,
Invisible, voiceless, but active the while.

And starlight and moonlight, and sunshine and storm,
Lent their varying hues to her transparent form,

And the o'erhanging branches dropped green shadows down
On the flickering sands of the water bed brown.

The minnows above her oft swam to and fro,
And naviculæ sailed o'er the pebbles below,

For the Spring time had come with its warmth and its light,
And the cells of the desmids were verdant and bright-

Closterium segments divided anew,
And the horns of the fair scenedesmus grew,

And the rayed rhizopoda clung lightly between
The filaments of the spirogyra green—

For the season had sent her primordial thrill
Through all protoplasm and chlorophyll.

And the Rotifer, glad in her limpid retreat,
Wheeled through the fair water on cilia fleet.

But a Student, whose nerve cells and brain matter gray
Were attuned to the touch of the sun's vernal ray,

Came, wandering over the vivified sod,
To explore this fair pool with his bottle and rod

And he gathered spores, larvæ, and desmids a few
Some diatoms fresh, and the Rotifer too.

Transferred to the slide of a microscope stage,
And held by a cover-glass close in her cage,

Did the Rotifer sigh for her home in the pool,
And for freedom to roam through its water ways cool?

In the close compressed water and unchanging glare,
Did she long for green shadows and free-flowing air?

Oh, no, she exhibited no such emotion,
But by wheeling and turning soon gave us a notion

She was rather enjoying the new situation,
Though too busy to rest from her old occupation.

And we said it was better this short life to yield
To the great cause of science, in microscope field,

Than to live its few days out unseen and unknown
In ever so pleasant a pool of her own.

Giving this as the fruit of our deep cogitations
The Student we left to his long lucubrations.

Pittsfield, N. H., March, 1881.

A New Liquid Glue.

A solution of 1 part of sugar in 3 parts of water, when appled to paper, gives to the latter neither lustre nor binding properties; but if to the solution be added ¼ part of slaked lime (calcium hydrate), and the mixture, after heating to 145° to 165° F., be macerated for a few days with frequent agitation, most of the lime will dissolve, and the syrupy solution possesses both adhesive and glazing properties. If to 12 or 15 parts of this solution be further added 3 parts of lime, in small fragments, the latter will rapidly dissolve on warming, and, on cooling, will remain liquid, without losing its adhesiveness. According to the quantity of saccharate of lime present, the consistence of the liquid glue will vary; but, in all cases, it will have a strong adhesive power. This liquid glue may be used for a variety of purposes, but must not be employed in presence of coloring matters, which are decomposed by lime, such as Prussian blue, zinc-green, etc.—*Polytech. Notizblatt.*

Dying Horsehair.

Horsehair, from its strength and other characters, is often very useful in amateur work. Black and reddish-brown hairs are easily procured, but where other colors are needed we must procure nice white hair and dye it. This is done as follows: Brown—The hair must first be thoroughly cleansed by placing it in a soap bath, heated to 133°, for twenty-four hours, and moving it about frequently. It must then be allowed to lie for twelve hours in a dye bath, prepared from a decoction of logwood with lime-water at 122°, and then be rinsed and dried. Blue, inclining to violet—The hair must first be dyed brown, as just given, and then passed through water, to which a little of a solution of ten and a half ounces of tin in thirty-five and a quarter ounces of hydrochloric acid has been added, and then washed as in the previous case. Blue—The hair must be prepared in a solution of two parts of alum and one part tartar, wrung out, and passed into an indigo bath, prepared with fuming sulphuric acid, and then rinsed and dried. Red—The hair must be prepared by placing it for half an hour in a tin salt bath, prepared like that for violet blue; after wringing it out it must be dyed with Brazil wood, to which some alum has been added, by allowing it to remain in the dye-bath for twenty-four hours, and then rinsing and drying.

— Repeated applications to copper or brass of alternate washings of dilute acetic acid and exposure to the fumes of ammonia will give a very antique-looking green bronze.

Practical Hints.

Cleaning Ivory and Marble.—The *English Mechanic* gives the following recipes: Polished marble or alabaster, when soiled, may be cleaned with a weak lye of potash and soft soap. Muriatic acid is the best thing for removing iron stains; it should be applied with a rag, but if used too freely or too strong will make the surface rough. The following is the best recipe for removing ordinary stains from ivory or marble: Dust-lime is mixed with the strongest soap-lye pretty thick, and instantly, with a painter's brush, laid on the whole of the marble. In two months' time wash it off perfectly clean, then have ready a fine, thick lather of soap (soft) boiled in soft water; dip a brush in it, and scour the marble, not with powder, as in common cleaning. This will, by very good rubbing, give a beautiful polish. Clear off the soap, and finish with a smooth, hard brush till the end be effected.

To Polish Aluminium.—M. Mouray recommends the use of an emulsion of equal parts of rum and olive oil, made by shaking these liquids together in a bottle. When the burnishing stone is used, the peculiar black streaks first appearing should not cause vexation, since they do not injure the metal in the least, and may be removed with a woolen rag. The objects in question may also be brightened in potash-lye, in which case, however, care must be taken not to make use of too strong a lye. For cleaning purposes benzole has been found best. Objects of aluminium can be electroplated without the least difficulty, and Mouray succeeded in imparting to them a bright white lustre in passing them successively through a weak bath of hydrofluoric acid and aqua fortis. The effect thus obtained is said to be quite surprising.

To Remove Nitrate of Silver Stains.—Dr. Kraetzer, of Leipzig, proposes, as a substitute for potassium cyanide in removing stains made by nitrate of silver, the following: Ammonium chloride, 10 grams; Corrosive sublimate, 10 grams; Distilled water, 100 grams. Preserve in a glass-stoppered bottle. He says that with this solution the black stains may be removed from linen, cotton, and woolen goods without injury of the fabric. It will also remove these stains from the skin, but although it is less poisonous than the cyanide, it is a corrosive poison.

Fire-Proof Cement.—No cement that contains organic matter, such as oil, glue, etc., can resist a low, red heat. For a cement that will resist any heat above that of melted lead we must use materials that are of an entirely mineral character. Finely-powdered asbestos, made into a paste with silicate of soda, forms an excellent fire-proof cement. It hardens quickly, makes joints that are steam and gas-tight, and stands any ordinary heat.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business letters or cards they cannot be used.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

For exchange, pocket lantern and instruction books for cornet and clarionet; wanted History of the "Franco-Prussian War," and the "Lost Cause." C. W. Hughes, Shreve, Wayne Co., Ohio.

Send for exchange list of insects, especially Coleoptera and Lepidoptera. Philip Laurent, 621 Marshall St., Philadelphia, Pa.

I have Brown's heavy scroll saw attachment, worth $6, which I wish to exchange for a lathe chuck or offers. C. B. Russell, Waterbury Centre, Vt.

Will exchange magnets, electric battery, as good as new, cost £3 in England, for plating battery and materials, or offers. F. Whitehead, Box 55, St. Augustine, Fla.

American and foreign coins to exchange; state what you have. W. J. Allen, 126 Twenty-third Street, Brooklyn, N. Y.

To exchange, fine imported game fowls of the best strain for Fleetwood scroll saw, compound microscope, telescope, magic lantern, shot gun, or offers. E. Alexander, Johnstown, Fulton Co., N. Y. Box 47.

Wanted, scientific books, minerals fossils and Indian relics, in exchange for minerals, fossils Indian relics, shells, etc.; send for lists; correspondence in German and English. A. W. Baily, Box 712, Atlantic City, N. J.

J. T. Bell, Franklin, Pa., has set of ivory chessmen, German flute, six extra keys, value $12, books, etc., to exchange for magic lantern, music box, guns, revolvers, or offers.

Birds eggs and arrow-heads to exchange for fossils and minerals, and birds eggs; send for my list. Clement G. Burns, Salem, Col. Co., Ohio.

Minerals (zeolites, etc.), to exchange for other minerals; state what specimens you have to exchange. H. L. Clapp, 35 West Cottage St., Roxbury, Mass.

Cabinet mineral specimens of Idaho in exchange for books, minerals, curiosities, etc., etc.; send for list and state what you have to exchange. P. Clough, Junction, Lemhe Co., Idaho.

Type, in exchange for curiosities, fossils, etc. Geo. K. Fischer, 729 North 6th St., Philadelphia, Pa.

I have some stamps which I would like to trade for stuffed birds, birds eggs and nests; I am also open to an offer; send for list of stamps. A. G. G., Box 26, Summit, New Jersey.

U. S. and foreign postage and revenue stamps for others; U. S. match and medicine especially; send list or sheet and I will do the same. B M. Hammond, cor. Elm and Live Oak Sts., Dallas, Texas.

To exchange for 1 new Vol. II, Young Scientist, 1 new Vol. I of ditto, and Prof. Bell's Lectures on the Telephone. F. H. Burger, Chester, Pa.

I have 2,000 foreign stamps that I would like to exchange for others. F. Cushing. P. O. Box 178, Wattsburg, Erie Co., Pa.

Wanted, a hand or self-inking printing press, small size, in exchange for books, magazines, papers, etc. B. D. Howell, High Bridge, Hunterdon, Co., N. J.

Demas lathe sea shells, rubber boots, California woods, Young Scientist and paper shells, for stencil dies, boxing gloves, revolver, foils, book on navigation, and manly arts. A. W. Port, San Diego, Cal.

To exchange, an $8 Challenge self-inking printing press, chase 3 x 5 inch, for type or offers. Address, by sealed envelope, Wm. F. Hill, 666 Bergen St., Brooklyn, N. Y.

To exchange, a $60 Wardwell (2 spool) sewing machine, nearly new, also a $3.50 stylographic pen, for coins and books, or offers. C. C. Bulkley, 195 Sigourney St., Hartford, Conn.

Wanted, to correspond with some one living near the ocean beach; also some one living near any lead or copper mines. Ewing McLean, Greencastle, Ind.

Wanted back numbers of "American Naturalist" and "American Journal of Science and Arts" (Silliman's Journal), for beautiful specimens, named, of American ferns, mounted or unmounted. Box 16, Pine Plains, N. Y.

An Official Printing Press, must be in good order, and type to make a complete printing outfit; state what is wanted in exchange. W. E. Cushman, Hartford, Ct.

Minerals, birds eggs, shells, woods, stamps, nests, books, insects, etc., to exchange for coins, stamps, minerals, birds eggs, insects, and fossils; send for my lists. Frank F. Fletcher, St. Johnsbury, Vermont.

Wanted to exchange 1 copy of Instruction in Wood Engraving, or set of dozen prints, suitable for practice, for specimens of algæ or minerals. S. E. Fuller, 25 Bond St., New York.

Wanted, copy of book called Corner Cupboard, and other scientific books; state what is wanted in exchange. G. S. Griffin, Emporia, Kansas.

Mosses from Germany, Colorado, and Illinois, also plants, Phænogamous and Crytogamic, to exchange for other mosses, lichens, liverworth, or algæ, East and South. Prof. P. Fr. Shuelke, Box 128, Pekin, Ill.

A large number of books, papers, and magazines, to exchange for type, printing material, or offers. J. T. Jackson, Box 48, Metuchen, N. J.

Minerals to exchange for other minerals; state what specimens you have for exchange. Samuel Wynne, Box 54, Phoenixville, Pa.

Will exchange, for printing outfit or shot gun, 6 years Nos. of Scientific American, with Supplement of 1876, 545 foreign and U. S. stamps, Art of Swimming, Instruction in Shorthand, and other books. W. A. Smith, West Randolph, Vt.

Insects and butterflies from China; state what is offered in exchange. Edward Laurent, 621 Marshall St., Philadelphia, Pa,

Good Specimens of the 17 years' locust (17 year cicada), in exchange for any kind of insects, beetles, moths, or butterflies. Harry C. Beardslee, Painesville, Lake Co., Ohio.

Birds eggs, books, foreign stamps, a good hammock, and revolver, to exchange for birds eggs and works on birds. F. D. Brown, Gallupville, Schoharie Co., N. Y.

A magic lantern with eight slides, cost $5, and other things, to exchange for scientific books, chemicals, or chemical apparatus, etc. A Campbell, Box 31, Derrick City, McKean Co., Pa.

Contributions to the Extinct Vertebrate Fauna of the Western Territories, by Joseph Leidy, Vol. I, in exchange for a similar work on Botany. F. O. Jacobs, Newark, Licking Co., Ohio.

THE Young Scientist

SCIENCE IS KNOWLEDGE.

INDUSTRIAL PUBLICATI

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

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Color.

If we admit a beam of ordinary white light (sunlight) into a darkened room, and let it fall upon a triangular prism, it will be separated into different kinds of light, and these received upon a white screen will give us the solar spectrum with its familiar rainbow colors. It is thus separated because the shortest light waves are deflected more from their original course by the prism than the longest waves.

Accordingly we find the red light least refracted, and following it in succession come orange, yellow, green, blue, and violet, the last being at the opposite end from red. Indigo as a distinct color of the spectrum is now disregarded. If we select by the most careful process a beam of one of the colored lights from the spectrum, and let it fall upon a second prism, we shall find that it remains unchanged; therefore, these colors being incapable of further analysis, have been called primary colors. We can, however, produce any of these colors by a proper combination of three of them, viz.: red, green, and violet, which Dr. Young first pointed out as the true primary colors. It is still an open question whether violet or blue is to be considered as the third member of the group. Red, blue, and yellow cannot be regarded as primary colors, for it is impossible to produce green light by the combination of blue and yellow light; they produce white light. On the other hand, yellow light results from the mixture of red and green light; blue light from the mixture of green and violet, and orange from red and yellow; so that we have thus all the colors of the rainbow.

Since red, green, and violet can be thus combined, they can, of course, also be so combined as to reproduce white light; but white light can be obtained not only by combining these three directly, but also by combining yellow and a proper hue of blue, since blue is composed of

violet and green light, and yellow of red and green; or we can combine yellowish-green and violet, and so on.

We have seen that white light may be produced by combining two colors; two such colors are called complementary colors, and the study of complementary colors is of great importance to the artist. The complementary color of red is bluish-green; of orange, sky-blue; of yellow, violet-blue; of vioiet, greenish-yellow; of green, pink. There are certain laws of harmony and contrast in color, which the artist must know. Simple contrast exerts an important influence, since it heightens the effects of colors, if complementary. Thus green appears brightest by the side of red, or violet beside yellow; but if mixed, such colors destroy each other, producing grey. Two colors, not complementary, if placed side by side, diminish each other's effect. If two colors are placed side by side, each will be modified, as if mixed with the complement of the other. Thus, if red and blue are placed together, the blue will receive a tinge of green, the complementary of red, while the red will receive a tinge of orange. It is by this contrasting of colors that the artist produces his most subtle effects, lowering or strengthening one color by working upon its neighbor. The light in which we view a color affects it; blue drapery under the cold light of the northern sky is heightened by the light; but if the light is orange, as from a brilliant Southern sun, the blue is bluer in the shade than in the light.

A tasteful person will always observe these principles, and, in dressing, combine colors which enhance each others effect. A rosy face is made still fresher by a green dress or bow; a green dress looks well with a red scarf; but no one would ever wear a purple dress with blue trimmings, or throw a scarlet shawl over a crimson dress.

We will only pause to consider two facts previously stated. We have seen that yellow and blue light produce white when mixed, and yet we know that if we mix yellow and blue paints we get green. To explain this we must remember that these paints consist of more or less transparent particles, and the light which comes from them to our eyes is reflected partly from their inner surfaces, or from the paper below. They produce, therefore, the same effect that would be produced by looking through a piece of blue glass and a piece of yellow glass together. The blue glass is transparent only to green and violet rays, with their resultant, blue; while the yellow glass transmits only red and green, with their resultants, orange and yellow; hence only the green light can pass through both.

The second fact is that the same object, illuminated by the same light, may appear of different colors to our eyes under different conditions.

If we look steadily for one or two minutes at a bit of bright red paper on a white background, and then quickly remove the red paper, we perceive a bluish-green spot on the background, which to the eye, in its normal state, would have appeared pure white. We have fatigued the red nerves, and when suddenly exposed to the white light they fail to act, hence the sensations of green and violet light only are produced. If we fatigue the violet and green nerves by looking steadily at a bluish-green spot, and then quickly look at the purest red color of the spectrum, it will appear of a purer red than we can obtain in any other way. Employing this principle, the artist can give a green tint to a white spot on his paper by surrounding it with red.

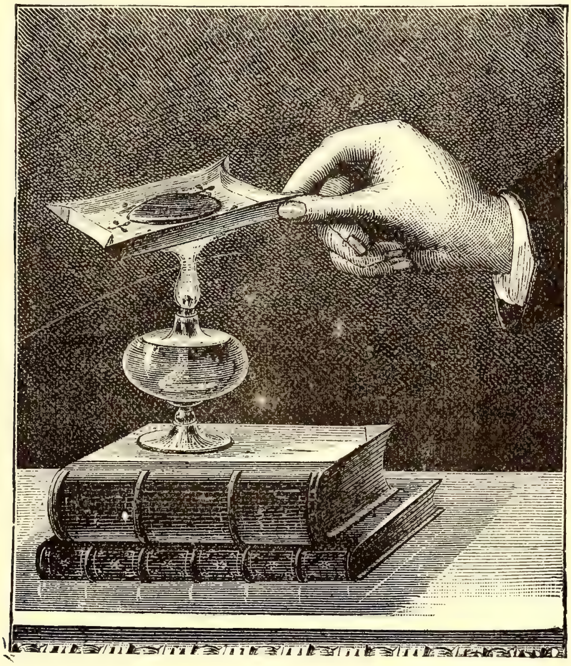
Curious Experiments With Fire.

In a former article we showed how water might be boiled in a paper vessel by simply holding it over a lamp or candle. In this case, however, the paper is thin, and the water carries off the heat so rapidly that the outside never has *time* to get hot. If we were to make a large vessel, capable of holding several gallons, of a material like paper, it would be so thick that the heat would not pass through it quickly enough, and the outside would burn while the inside was cold. Try to boil water in a wooden pail by holding it over a fire, and see what poor work you will make. But the In-

dian boils water and makes soup in a basket! The basket is so well made that it is water tight—just like a wooden pail, and holds water or soup, or any other liquid! But he does not hold the basket over the fire; he puts the fire in the basket, and he does this by heating smooth stones quite hot, and then plunging them in the liquid. In this way he soon makes the water boil.

As a curious example of heating water in a wooden vessel, we may mention the first steam boilers made in this country. Iron was then scarce and dear, and the facilities for working it were not very good, so Oliver Evans made his steam boilers of wood, just like so many barrels, and through them he passed iron tubes. These tubes conveyed the flame and hot smoke, so that the water was quickly heated and steam raised. On the whole, although they were not equal to our modern iron and steel boilers, these wooden boilers were very serviceable.

Another curious problem may be stated thus: To boil water in a common tumbler over a lamp or gas flame. This is easily accomplished as follows: Over the mouth of a tumbler full of water place a sheet of close-grained paper; press it on tightly, and quickly invert the tumbler. Instead of the water falling out, it will remain in place, and the paper will not fall off. The inverted tumbler may then be held over the lamp, when the heat will pass readily through the paper, which will not be burned, however, and the water will quickly become hot. And now comes a curious point in this experiment. As soon as the water boils and steam is formed above it in the tumbler, the pressure of the air, which formerly held the paper and water in place, is counterbalanced, and both paper and water fall to the ground. To prevent this, if we desire to carry the heat to the boiling point, we must *tie* the paper firmly over the mouth of the tumbler, and we can then raise the water to the boiling point with safety. But we must not make it any hotter than



MELTING METAL IN A CARD.

boiling, or our cover will be blown off, since we have here a veritable steam boiler, of which the paper cover is the safety or rather the *danger*-valve.

The most extraordinary experiment (next to stirring molten lead with the naked hand, a feat which we will explain hereafter) is that of laying a piece of fine cambric or thin muslin on a red hot coal without burning it! This is easily done by stretching the fabric tightly over a polished metal ball before bringing it in contact with the coal. The metal will conduct the heat away so rapidly that it will be impossible to burn the cambric.

So, too, a piece of lead, tin, or any similar metal may be melted in a thin cardboard dish by holding it over a lamp, as shown in the figure. The only condition that is necessary is that the metal shall melt at a temperature below the point at which cardboard burns. Common solder is a good metal with which to try the experiment. We might use fusible metals, some of which melt at a temperature less than that of boiling water, but this would not be a fair illustration of the principle we are illustrating.

A Talk About Bows and Arrows.

"YOU see," said Dr. Carver, as he deposited a whole sheath of brightly feathered arrows on a table, took off his umbrageous felt, and drew up a chair, "I must be shooting something or other all the time. If it isn't a Winchester, it's a bow and arrow. Pretty, they are. But most too fine! Fancy thing, these arrows, for handsome young ladies to shoot on grass plats at straw targets. Now an Indian arrow is a good bit longer—maybe 32 inches—and when a Sioux draws it chock up to the bow it fairly hums when he lets it fly. An Indian arrow has grooves cut in it behind the barb—that is to say, the ones they use in hunting—so that the blood can flow, otherwise the wound would spoil and swell. The fighting arrows are nasty things. The barb is so put on the shaft that when it hits you the steel, or old hoop iron, stays in the flesh when you go to pull out the arrow. Dear sakes, what ugly wounds I have seen them make! An Indian boy begins to handle a light bow when he toddles, maybe at four or five years. His bow is taller than he is. He shoots at almost anything around the camp. When he is twelve he uses sharp arrows. A boy must be strong at eighteen to use a man's bow. Now, a white man who takes an Indian bow for the first time has all he can do to bend it. It wants some strength, but more knack. The bow is made straight. When it is strung, the cord, even when in tension, almost touches the bow. It is thick, some four and a half to five feet long—that is, their hunting bow—and has extra stiffness by having sinews pasted on it. I have seen We-shessa-has-ka—that is the Long Man—and he was the best of the Ogalalla Sioux, kill an antelope with his arrows at 125 measured yards. We-shessa-has-ka was nearly seven feet tall, and a good Indian. On horseback, broadside to a buffalo, I have more than once known that Indian to send an arrow through a big cow. The arrow hung out on the other side. The bow for horseback and for war is a trifle shorter, and may be stiffer. You do not draw the arrow to the eye, but catch aim as I do when shooting from the hip. That can be acquired only by long practice. The string is drawn by the clutch of the whole fingers, though some of the tribes use the thumb and three fingers. The long man could shoot an arrow in the air out of sight, and so can I (the doctor pointed to an arrow buried up to the feathers in the ceiling of our office, his own peculiar ornamentation of the Forest and Stream sanctum). I think that in a couple of months I could get into perfect practice, for I used to hold my own with any Indian on the plains. Sometimes, after I had been shooting with my Winchester, an Indian would come up and show his bow, and tell me his bow was 'muchee good;' but then I used to take his own bow and beat him at it.

To pass away the time when I was at the Brooklyn Driving Park, I bought an English bow and arrows of Holberton, and soon got into the trick of it. I hit blocks of wood thrown into the air quite as often as I missed them. The English bows and arrows are fancy, but good. I

would rather have an old Sioux one, made of hickory or ash, but the boss bow I ever owned was made of buffalo ribs. An Indian carries his quiver of arrows over his right shoulder, so that he can get his arrows quickly. When he has discharged one arrow, with the same motion that he uses in pulling the string he clutches another arrow. If he shoots one hundred yards he has three or four arrows in the air all going at the same time. It's great fun shooting at a bird with a long tail that flies over the prairie. Knock out his tail and his steering apparatus is gone. I have knocked the tail out of many a one, and so caught him in my hands when he tumbled."—*Forest and Stream.*

Cheap Lathes and How to Use Them. III.

HOW TO CHOOSE A LATHE.

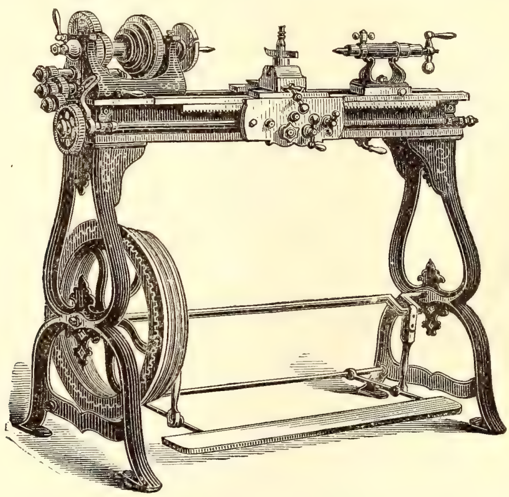
HAVING decided as to the size and general character of the lathe that will best suit our requirements, the next thing to be done is to select from those in market a well-made sample of the kind of lathe that is wanted.

If the lathe be a very cheap one, it must not be expected to be perfect in its parts and movements. Still, even in this case, the spindle should run easily, the balance wheel should have sufficient weight, and the framework should be firm and without shake. To test the movement of the lathe, whether it be cheap or dear, throw off the band and turn the spindle by hand. It should move very easily and yet without shake, and when tightened a little in its bearings, so that it runs just a trifle stiffly, it should move quite as easily at one part of its revolution as at another. The latter is a principal point to be attended to in all lathes. If the spindle moves easily and freely for half a turn, and then binds and becomes stiff in its movements, it shows that spindle and bearing are not round and true. This is a very bad defect, and it can be detected only in the way we have pointed out, viz., by throwing off the band, tightening the bearings of the spindle, and turning the latter by hand. So long as the band is on, especially if it be pretty tight, the spindle will be held down so that it will show no shake to the hand; but the moment it is used for work, and the chisel is applied to the article that is to be turned, the band becomes unequal to the task of holding it down, the piece that is being turned will jump, and the work will be untrue. All this shows itself when the band is no longer in place to keep the spindle down and make it run *apparently true.* In a well-made lathe you may tighten the bearings of the spindle until you can hardly turn it, and still you will find that it moves without any perceptible difference throughout the entire revolution.

The fly-wheel next demands our attention. The temptation to make this part very light, and thus save material, is strong, but when yielded to, it works nothing but evil for the purchaser. In very light lathes the fly-wheel and treadle may be built on the sewing-machine plan, and indeed an old sewing-machine stand sometimes answers very well for a very light bench-lathe. In this case the fly-wheel may be light, because it is driven on both the upward and downward motion by the foot—the treadle being so arranged that the foot *rocks* instead of having a clean sweep up and down. But it is impossible to get much power in this way, and in most lathes the treadle is so made that the foot moves up and down, and the fly-wheel is driven only through half a revolution, the other half being accomplished by its own momentum. If, therefore, the fly-wheel has not weight enough to carry it round with a speed almost as great as that which it takes on the down stroke of the foot, the motion will be variable, and the work will be untrue. The only way to secure equable motion in the fly-wheel, is by weight; see, therefore, that it has it.

Some of our readers may, however, already own a lathe with a very light fly-wheel. This may be remedied by wrapping the arms with lead, or by screwing blocks of metal to the wheel. The young workman will, of course, see that this additional metal is so distributed that the wheel is not made heavier one side than on another, and he will also take care that the extra material is so firmly secured that there is no danger of its flying off.

There is, of course, a limit to the power that can be obtained from the foot and fly-wheel alone, and this limit is a comparatively narrow one. Where the amateur desires to turn up heavier articles, particularly pieces of metal of considerable size, he must have recourse to gearing, and he will then select either a simple back-geared lathe, as it is called, or, if his means will allow it, a complete self-acting lathe, such as is shown in the engraving. Such a lathe is not by any means a *cheap* lathe, but we introduce a figure of it here for the purpose of showing what is necessary to constitute a *complete* lathe, and thus to point out to our readers what they must *not* expect from the incomplete tools which are sold at a low price. In the lathe shown in the engraving, the driving parts may be so arranged that the spindle is not driven directly by the belt, but by the large gear-wheel at the right-hand end of it. This wheel is driven by a pinion on the same spindle which carries the large gear-wheel to the left, and this latter wheel is driven by a pinion on the cone which takes the belt from the fly-wheel. It will be seen that a very fast motion of the fly-wheel and cone is reduced to a very slow motion of the spindle, and of course the power (as it is sometimes called) is greatly increased. By means of this arrangement we have been frequently able to take off a heavy cut from an iron bar two or three inches in diameter in a foot-driven lathe.



SELF-ACTING FOOT LATHE.

How to Make a Pretty Basket.

MAKE a basket of wire; see that it is symmetrical and in good shape. The wires may be tied with woollen yarn at their junction with each other. Twist round the wires, at given points, woollen yarn. Make a hot solution of alum water; make it as strong as possible. Suspend the wire basket in the solution, so that it will not not touch the vessel, but will be wholly covered by the liquid. Let the basket remain still in solution for twelve hours, when it will be found that the alum has crystallized over the whole surface of the basket in a most beautiful manner. This gives a white or frost-like appearance; for other tints the following coloring substances may be employed: For yellow, turmeric; for red, solution of litmus; for purple, logwood; for blue, a solution of soluble Prussian blue; for green, the first and last mixed to suit taste. These coloring substances should be mixed with the solution while it is hot. The colored crystals are much more easily destroyed than those of pure alum. The best way to keep ornaments of this

kind clean is to place them under glass shades. Other things than baskets may be ornamented by this process, such as wire easels for pictures, match-safes, etc., etc.

Three Amateur Workers—and What They Did—VIII.

BY FRED. T. HODGSON.

THE body of the house being put together, and the partitions being marked off and placed in proper position, it became necessary to make provision for the roof. This was done by taking

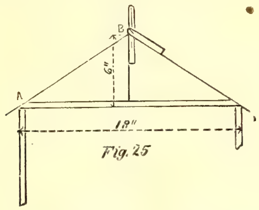


Fig. 25

two boards, twelve inches wide and three feet four inches long, and beveling one edge of each to the angle shown in Fig. 25. A shows the proper angle to bevel the pieces; B, the bevel made on the top of the house to receive the roof. The figures explain themselves. Mr. Carpenter made a diagram or plan the full size, on a planed board, with a lead pencil. This enabled the boys to get the angles and sizes exactly, which they did without any trouble.

The boys left the boards four inches larger than the house, in order to allow the roof to project two inches over each end, the same as on the sides. After the roof was placed in position and nailed on to the top of the honse, on a line with B, Fig. 25, it was found that the gables at each end were open, and pieces of thin stuff were cut the right shape to fill the opening, and drop down low enough to nail on to the ends of the house. This being done, it was decided to have a gable or pediment in front, to "set the house off," as Ellwood termed it, and in this gable a window was cut, as appears in Fig. 26, which shows the house just as it appeared when finished, all but the front.

This engraving (Fig. 26) is on a scale of one-sixteenth of an inch to one inch; that is, each one-sixteenth of the cut, measured in any direction, equals one inch actual measurement on the house. If you measure across the picture, you will find that it is just two and a quarter inches, or 36 sixteenths of an inch; well, the house, as built, just measures thirty-six inches.

Mr. Carpenter fully explained this matter to the boys, and showed them that any part of the picture was just one-sixteenth of the size of the corresponding part on the house as built.

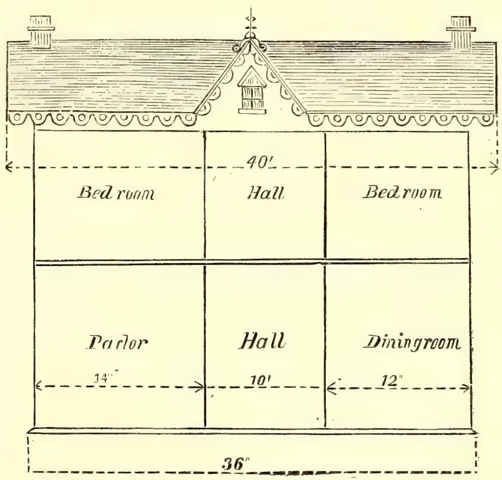


Fig. 26.

As the house now stood, bare and open in the front, it did not present a very nice appearance, and Jessie seemed somewhat disappointed at its looks. She soon made known her feelings by asking her father "if that was all that was going to be done to her dolly's house?"

"Why no, my dear," said Mr. Carpenter, "we are going to put a front on it with five windows and a hall door, and then we will paint the body olive-green, and the trimmings of the windows, door, and cornice a deep Indian red. The front will be made in two pieces and hinged on the sides. It will part on a line with one of the partitions. When you wish to see the inside or adjust any of the furniture, you may open one or both sections of the front. Of course, Jessie, you will have to

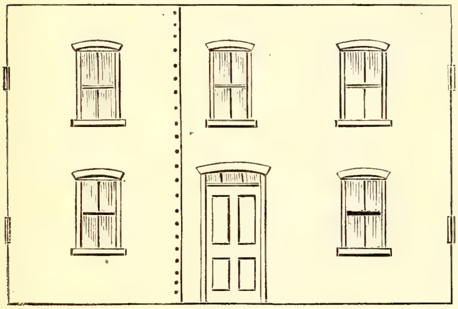


Fig. 27.

paper all the rooms and ceilings yourself, and according to your own taste."

Jessie was quite pleased with this explanation, it was all she required; and she began to form plans in her own mind for furnishing and decorating her new house.

Several evenings elapsed before the house was complete. Two chimneys had to be made of thin stuff, and in proportion to those shown in the cut, Fig. 26; they were painted red and striped like brick work. A flight of stairs was put up in the hall, and Fred sawed out an ornamental baluster and rail for the stairs all in one piece, with newel post and side string. All this work was done with the new scroll saw; and the wavy pieces and scroll ornament on the gable were cut out with the same tool. The windows were cut out of the "solid," and strips of tin were run across the openings on the inside, and nailed with small-headed tacks. These strips of tin were about three-sixteenths of an inch wide, and represented the sash bars; sheets of glass were then placed over the strips, and other tin strips were then run over the inside of the glass and nailed down to the wood close to the edges of the glass. These second strips represented the sash bars on the inside, and answered the purpose of holding the glass in its place. These strips were painted in appropriate colors on both sides of the glass.

At the entrance a front door was represented by painting, but the fanlight over the door was cut out of the "solid," like the windows, and was treated the same way, only that the glass used for the purpose was colored.

In cutting the openings for the windows and fanlight, it was necessary to first mark them out the size required. When this was done, a hole was bored in one

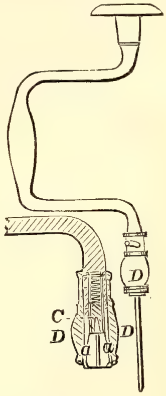


Fig. 28.

corner with the brace and bit (Fig. 28), into which the point of the key-hole saw (Fig. 29) was inserted, and the opening

Fig. 27 shows the front. It is made of stuff half an inch thick, and is in two parts, being divided at the dotted lines. Each part should be hinged to the sides of the house with small hinges, which are placed about as shown in the cut. The doors may be held closed by a "button," or any other suitable device.

Fig. 28 shows an iron brace with bit inserted. *a a* show the jaws, which are opened and closed with a sleeve nut, D. The end of the bit presses against a movable centre-piece, which has a spring behind it.

was made larger by sawing close to the lines. A little difficulty was met with

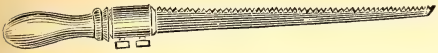


Fig. 29.

when the saw had travelled to the corners; it was found that the saw would not turn at right angles and leave a nice square corner. This trouble was got over by first sawing "square up into the corner," and then taking the saw back about an inch from the angle and starting it in the wood again, and making a short curve with it until it struck the line. The sawing was continued in this direction until the next angle was reached, when the saw was taken out and turned with its teeth in a contrary direction, and the little curve in the corner just passed was cut away. All the other corners were treated in a similar manner.

The house proper was finished, so far as the boys were concerned, but, as they had promised to make furniture for it, they had still plenty of work on hand, and Jessie was quite anxious, now that the house was built, to get it furnished and completed; so it was decided to go right to work at the furniture.

Let us see how they get along!

(To be continued.)

The Water Telescope.

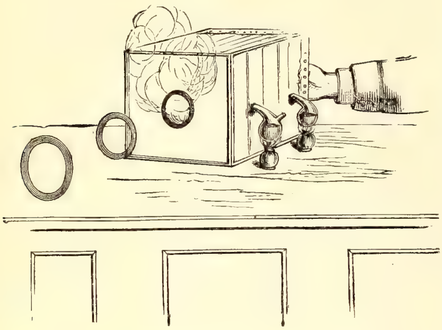
THIS efficacious and cheaply-made instrument is not used so much in this country as its merits deserve. The Norwegian fishermen are constantly in the habit of employing it in their herring and cod fisheries, and often thereby discover shoals of fish that would otherwise escape their nets. On the surface of the water in the sea, and also in most rivers, there is generally a ripple, which prevents the bottom being seen; it is to get rid of this ripple that the water-glass is so useful. There are two forms of water glass—namely, an ordinary bucket or barrel, with the bottom knocked out; second, a piece of tin of a funnel shape, about three feet long and nine inches diameter at the broad (or bottom) end, and large enough at the top to accommodate the observer's eye—into the broad end should be inserted a plate of strong glass, and some lead to weigh it down. When the water is clear this instrument will enable the observer to see from three to twenty fathoms on calm bright days. Of course when the water is muddy or discolored the glass is useless. The Cornishmen, especially at the Landsend, use these instruments for looking for wrecks, lost crab and lobster pots, etc. To the naturalist they will be invaluable, as by means of them the actions of the fishes and other inhabitants of the ocean can be observed better than in any aquarium. The beauties and luxurious growth of the submarine forests of sea plants will also to many be a most novel and interesting spectacle. To water parties who picnic on rivers or near lakes, the water telescope will be found a great addition to the day's enjoyment, as by means of it subaqueous scenery may, possibly for the first time, be brought into view, and many a panorama opened up to the human eye quite as beautiful, if not more so, than many a view in distant countries where friends and relations are enjoying an expensive tour.

Fig. 29 shows a keyhole or pad saw. The blade is quite thin, and not more than ⅛ of an inch wide at the point. It is fixed in the handle by two set screws, which are adjusted by a screw-driver. A narrow slot runs through the handle, in which the saw may be lengthened or shortened.

Smoke Rings.

IN a former number of the YOUNG SCIENTIST we described a very simple device for showing the curious "smoke rings" which are produced when air, loaded with visible smoke or vapor, is expelled in puffs from any reservoir. The engraving shows a larger and more effective device for the same purpose. A cheap box (a small tea chest answers very well) has a hole bored in one end, and over the other is tacked a piece of stiff paper. Through two small holes in the side are inserted the nozzles of two small tube retorts, one containing hydrochloric acid, and the other strong liquid ammonia. The retorts are heated by two small lamps, and the vapors that are given off

meet in the box and combine, forming a dense white vapor. When the paper or membrane covering the end of the box is tapped smartly with the finger, the air and vapor rush out of the hole at the opposite end, and form magnificent white



SMOKE RINGS.

rings, which travel quite a distance, expanding and curling in a most beautiful manner. The experiment is one that is easily carried out, and it never fails to please. The arrangement we have figured is one that is well adapted to the lecture room.

Bird Paste.

Bechstein, a celebrated German ornithologist of the past generation, recommends the following pastes, both of which soon become sour, but the formula can be easily modified so that the food could be kept as a dry powder, which would not alter:

No. 1. Take a stale well-baked white loaf, soak it thoroughly in fresh water, squeeze out the water, and pour boiled milk over it, adding about two-thirds of well-sifted barley or wheat meal.

No. 2. Grate a carrot very finely, soak a small white loaf in water, squeeze it out, and put it with the carrot in an earthen pan, add two handfuls of barley or wheat meal, and mix thoroughly.

"The first paste," says Bechstein, "agrees so well with all my birds, that they are always healthy and preserve their feathers, so that they have no appearance of being prisoners. Sometimes, as a delicacy, they are given ants' eggs, or a few meal worms."

Mr. Sweet recommends the following: Hemp seed crushed very small, in boiling water, is mixed thoroughly with an equal quantity of bread soaked and squeezed dry, and an equal quantity of lean raw meat minced fine. Another authority says that, for the lark, barley meal, with cabbage, chopped cress and poppy seed, mixed with bread crumbs, or in winter with oats, forms a good food.—*Chemist and Druggist.*

Plating and Gilding Without a Battery.

A very useful solution of silver or gold for plating or gilding without the aid of a battery, may be made as follows: Take, say, one ounce of nitrate of silver, dissolved in one quart of distilled or rain water. When thoroughly dissolved, throw in a few crystals of hyposulphite of soda, which will at first form a brown precipitate, but which eventually becomes redissolved, if sufficient hyposulphite has been employed. A slight excess of this salt must, however, be added. The solution thus formed may be used for coating small articles of steel, brass, or German silver, or by simply dipping a sponge in the solution and rubbing it over the surface of the article to be coated. I have succeeded in coating steel very satisfactorily by this means, and have found the silver so firmly attached to the steel (when the solution has been carefully made) that it has been removed with considerable difficulty. A solution of gold may be made in the same way, and applied as described. A concentrated solution of either gold or silver thus made, may be used for coating parts of articles which have stripped or blistered, by applying it with a camel-hair pencil to the part, and touching the spot at the same time with a thin clean strip of zinc.—*Exchange.*

Preservation of Wood.

In speaking of the well-known methods of preserving posts and wood which are partially embedded in the earth, by charring and coating with tar, it is said these methods are only effective when both are applied. Should the posts be charred only, without the subsequent treatment with tar, the charcoal formation on the surface would only act as an absorber of the moisture, and, if anything, only hasten the decay. By applying a coating of tar without previously charring, the tar would only form a casing about the wood, nor would it penetrate to the depth which the absorbing properties of the charcoal surface would insure. Wood that is exposed to the action of water, or let into the ground, should first be charred, and then, while still hot, be treated with tar till the wood is thoroughly impregnated. The acids and oils contained in the tar are evaporated by the heat, and only the resin left behind, which penetrates the pores of the wood and forms an air-tight and water-proof envelope. It is important to impregnate the poles a little above the line of exposure, for here it is that the action of decay

affects the wood first, and where the break always occurs when removed from the earth or strained in testing.

Hard Colored Cements for Inlaying.

Colored cements are used to give cast goods of zinc or brass the appearance of buhlwork, and to fill up the holes made by etching in zinc door plates, street numbers, coats of arms, etc. They are also, with advantage, employed for making casting-models of more artistic objects, as well as for mosaics on metal ground; but they may be further found useful in engineering works for isolaters, large rings and plates. According to Stach, the following process gives good results: A solution of soluble glass of 33° Baume, is mixed with fine whitening, with the addition of the materials mentioned below, until it assumes the tenacity of a thick plastic mass, and thus different colored cements, hardening in six or seven hours, of considerable strength, and very useful for the purposes above quoted, are obtained. By adding gray-sulphuret of antimony a black cement is obtained; this may be polished with agate, and has a metallic onyx-like luster. Another black cement is prepared by mixing equal parts of sulphuret of antimony and iron filings (finest) with the above soluble glass; but the cement can only be ground. Carbonate of copper, pure chrome green, give green; cobalt blue, blue cements. (Ordinary ultramarine is not fit for use, because it decomposes and scatters the mass). Red lead gives orange cement, sulphide of cadmium citrine, cinnabar bright red, and cochineal-lac violet cement; zinc dust and alcoholized iron give a brown cement, and powdered manganese acts in the same manner. An especially valuable gray cement, which may be polished with the agate to a metallic luster, and used in the repair of damaged zinc ornaments—whether cast or of sheet zinc—is produced by mixing pure most finely-sifted zinc dust with soluble glass. Hitherto these mixtures have been used solely for imitating marble, but the cements are also of great value in the metal-ware industry.

Practical Hints.

Bronzing-Liquid.—Ten parts of aniline red and five parts of aniline purple are dissolved in 100 parts of 95 per cent. alcohol, on the water-bath, and the solution, after the addition of five parts of benzoic acid, boiled (for 5-10 minutes) until it has changed its greenish color to light bronze-brown. Applied with a brush upon *leather*, metal, or wood, the liquid produces a magnificent bronze coating.—*Bayr. Ind. und Gewerb. Zeit.*

Mica.—To the microscopist a world of interest may be found in the micas. They frequently contain between the layers microscopic crystals of minerals, some of them, especially with polarized light, forming specimens of wonderful beauty. Of most minerals, sections for microscopic examination must be made by the laborious process of grinding and polishing, but in mica we may almost say the sections are made by nature, and the time required to make one section of most minerals will make at least 100 of mica, and the thickness or thinness is a matter of perfect control.

To Color Horn Black.—C. Burnitz, of Stuttgart, uses the following method of accomplishing this without subjecting the material to a boiling heat: The articles, after being made ready for polishing, are to be placed in a lye of caustic soda, or potassa, till the upper strata of the horn have been dissolved to such an extent that the articles feel greasy to the touch. With care, even the finest tooth-combs may be thus treated. The articles are now washed in water, and drawn through aniline black, known as the Lucas aniline black, dried slowly, and then washed. The light passing through the horn has a deep-brown color; but by reflected light the article appears of a deep black.

Water-tight Parchment Paper Bags.—These are made by means of chrome-gelatin. A 15 per cent. solution of gelatin in water is warmed and mixed, *in the dark*, with a 3-5 per cent. solution of potassium bichromate. The mixture is poured into small black bottles, and kept carefully from the light, which would harden it and make it insoluble. Before use, the bottle is set into hot water, carefully preventing the access of daylight. When the cement is melted, the edges of the parchment-paper, which must have been wetted, are brushed over with the cement, and then rapidly dried in the sun. To test them they are filled afterwards with water and hung up in frames. Any hole which may be discovered is closed by means of the above cement.—*Pharm. Zeit.*

How to Clean Marble Top Furniture.—It may be of some value to housekeepers who have marble-top furniture, to know that the common solution of gum arabic is an excellent absorbent, and will remove dirt, etc., from marble. The method of applying it is as follows: Brush the dust off the piece to be cleaned, then apply with a brush a good coat of gum arabic, about the consistency of thick office mucilage, expose it to the sun or dry wind, or both. In a short time it will crack and peel off. If all the gum should not peel off, wash it with clean water and a clean cloth. Of course, if the first application does not have the desired effect it should be applied again. Another method of cleaning marble is to make a paste with soft soap and whiting, wash the marble with it, and then leave a coat of paste upon it for two or three days. Afterwards wash off with warm (not hot) water and soap.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business letters or cards they cannot be used.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

I have a new Munsen's battery, large size, which I wish to exchange for a good revolver or offers. Robt. T. Boyle, 351 West 83d St., New York.

Hair of American deer to exchange for diatoms, foraminifera, or other material. W. H. Osborn, Chardon, Ohio.

To exchange, full instruction in short-hand writing, and birds eggs, for birds eggs, postage stamps, or offers. M. F. E., 51 Spencer St., Albany, N. Y.

"History of Our Country," by Lossing, in six parts, price $15, to exchange for printing press or offers. Frank Chandler, Waverley, Mass.

Fine Devonian and Carb. fossils for others, especially cretaceous fossils, scientific books or papers; Pitman's short-hand works for books or offers. A. Stapleton, East Point, Tioga Co., Penn.

Wanted, scientific books and apparatus; send lists and say what is wanted in exchange. Ewing McLean, Greencastle, Ind.

Wanted, specimens in geology, entomology, oology, etc., for those in other localities, also coins and a charm microscope (magnifies 1,000 times) for one having a different view. J. H. Jones, Frankfort, N. Y.

For printing press or offers, achromatic telescope, $8.50; microscope, $5; set drawing instruments, $3; revolver, $3; Phrenological Journal, $2.50; books, 12 plays, farces, dramas, burlesques, etc., $1.80. F. E. Payne, Alma, Mich.

One pair 3 lb Indian clubs, one scroll saw, one pocket lantern, and a large number of books, for magic lantern, pair telephones, photographic camera, or offers. Thos. A. Black, Lock Box 678, Scranton, Pa.

For exchange, pocket lantern and instruction books for cornet and clarionet; wanted History of the "Franco-Prussian War," and the "Lost Cause." C. W. Hughes, Shreve, Wayne Co., Ohio.

Send for exchange list of insects, especially Coleoptera and Lepidoptera. Philip Laurent, 621 Marshall St., Philadelphia, Pa.

I have Brown's heavy scroll saw attachment, worth $6, which I wish to exchange for a lathe chuck or offers. C. B. Russell, Waterbury Centre, Vt.

Will exchange magnets, electric battery, as good as new, cost £3 in England, for plating battery and materials, or offers. F. Whitehead, Box 55, St. Augustine, Fla.

American and foreign coins to exchange; state what you have. W. J. Allen, 126 Twenty-third Street, Brooklyn, N. Y.

To exchange, fine imported game fowls of the best strain for Fleetwood scroll saw, compound microscope, telescope, magic lantern, shot gun, or offers. E. Alexander, Johnstown, Fulton Co., N. Y. Box 47.

Wanted, scientific books, minerals fossils and Indian relics, in exchange for minerals, fossils, Indian relics, shells, etc.; send for lists; correspondence in German and English. A. W. Baily, Box 712, Atlantic City, N. J.

J. T. Bell, Franklin, Pa., has set of ivory chessmen, German flute, six extra keys, value $12, books, etc., to exchange for magic lantern, music box, guns, revolvers, or offers.

Birds eggs and arrow-heads to exchange for fossils and minerals, and birds eggs; send for my list. Clement G. Burns, Salem, Col. Co., Ohio.

Minerals (zeolites, etc.), to exchange for other minerals; state what specimens you have to exchange. H. L. Clapp, 35 West Cottage St., Roxbury, Mass.

Type, in exchange for curiosities, fossils, etc. Geo. K. Fischer, 729 North 6th St., Philadelphia, Pa.

I have some stamps which I would like to trade for stuffed birds, birds eggs and nests; I am also open to an offer; send for list of stamps. A. G. G., Box 26, Summit, New Jersey.

U. S. and foreign postage and revenue stamps for others; U. S. match and medicine especially; send list or sheet and I will do the same. B. M. Hammond, cor. Elm and Live Oak Sts., Dallas, Texas.

To exchange for 1 new Vol. II, Young Scientist, 1 new Vol. I of ditto, and Prof. Bell's Lectures on the Telephone. F. H. Burger, Chester, Pa.

I have 2,000 foreign stamps that I would like to exchange for others. F. Cushing. P. O. Box 178, Wattsburg, Erie Co., Pa.

Wanted, a hand or self-inking printing press, small size, in exchange for books, magazines, papers, etc. B. D. Howell, High Bridge, Hunterdon, Co., N. J.

Demas lathe sea shells, rubber boots, California woods, YOUNG SCIENTIST and paper shells, for stencil dies, boxing gloves, revolver, foils, book on navigation, and manly arts. A. W. Port, San Diego, Cal.

To exchange, an $8 Challenge self-inking printing press, chase 3 x 5 inch, for type or offers. Address, by sealed envelope, Wm. F. Hill, 666 Bergen St., Brooklyn, N. Y.

To exchange, a $60 Wardwell (2 spool) sewing machine, nearly new, also a $3.50 stylographic pen, for coins and books, or offers. C. C. Bulkley, 195 Sigourney St., Hartford, Conn.

Wanted back numbers of "American Naturalist" and "American Journal of Science and Arts" (Silliman's Journal), for beautiful specimens, named, of American ferns, mounted or unmounted. Box 16, Pine Plains, N. Y.

An Official Printing Press, must be in good order, and type to make a complete printing outfit; state what is wanted in exchange. W. E. Cushman, Hartford, Ct.

Minerals, birds eggs, shells, woods, stamps, nests, books, insects, etc., to exchange for coins, stamps, minerals, birds eggs, insects, and fossils; send for my lists. Frank F. Fletcher, St. Johnsbury, Vermont.

Wanted to exchange 1 copy of Instruction in Wood Engraving, or set of dozen prints, suitable for practice, for specimens of algæ or minerals. S. E. Fuller, 25 Bond St., New York.

Wanted, copy of book called Corner Cupboard, and other scientific books; state what is wanted in exchange. G. S. Griffin, Emporia, Kansas.

Mosses from Germany, Colorado, and Illinois, also plants, Phænogamous and Crytogamic, to exchange for other mosses, lichens, liverworth, or algæ, East and South. Prof. P. Fr. Shuelke, Box 128, Pekin, Ill.

A large number of books, papers, and magazines, to exchange for type, printing material, or offers. J. T. Jackson, Box 48, Metuchen, N. J.

Good Specimens of the 17 years' locust (17 year cicada), in exchange for any kind of insects, beetles, moths, or butterflies. Harry C. Beardslee, Painesville, Lake Co., Ohio.

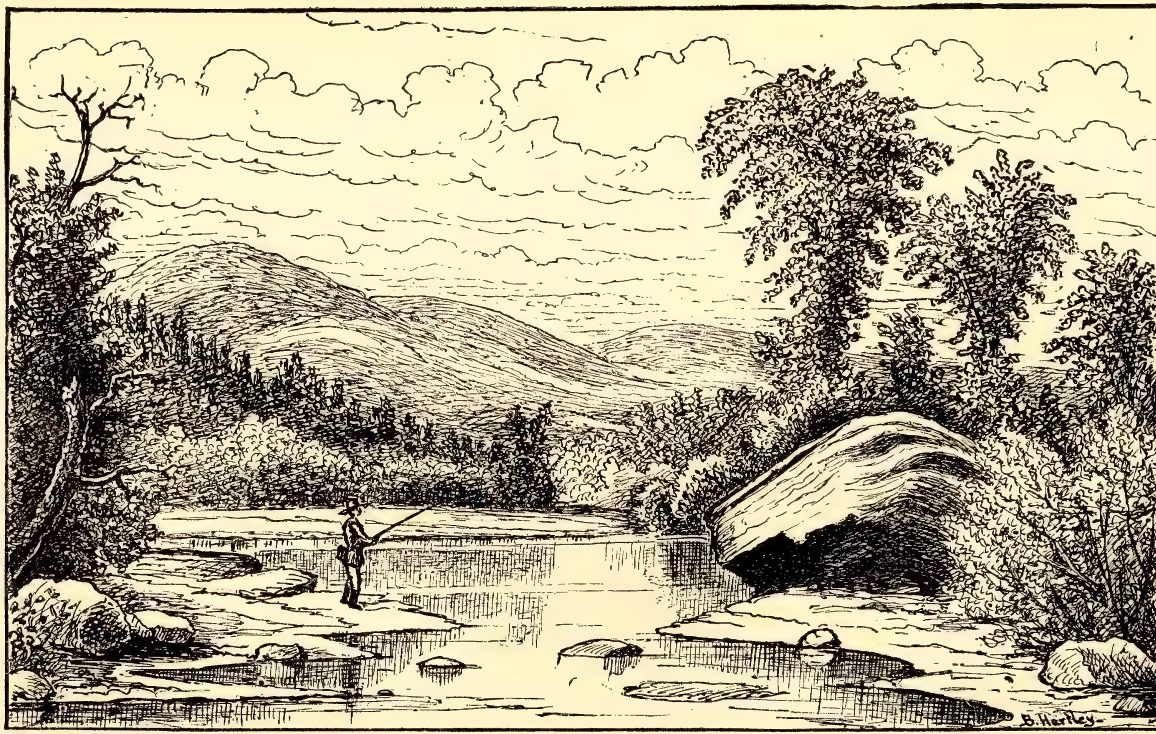


ILLUSTRATION OF COLLODIO-ETCHING. "Scene in the Catskills."

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

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Collodio Etching.

ACCORDING to a promise made in a previous number, we give our readers an illustration which shows as nearly as possible the results that may be attained by the simple art which has been described in a series of articles under the head of *Collodio Etching.* Our illustration is a wood engraving, and the artist has endeavored to show in *facsimile* the special features of pictures produced by this process. It will be seen that the lines are singularly free and sketchy, thus giving to the whole design a boldness which is not found in ordinary engravings. Of course, in order to make such drawings, in the first place requires some skill and experience, but it is wonderful what a little perseverance will do, especially with the aids which have been developed by modern science and art—one of the most efficient of which is described in the next article, which is from the pen of the author of the previous articles on this subject.

It gives us pleasure to be able to announce that the author of the papers on Collodio Etching, which have recently appeared in these columns, has thrown a more extended and minute series of instructions on this subject into the form of a book, which we expect to publish in time for the use of summer tourists. It will form a neat little volume, handsomely illustrated, not only with engravings of all the apparatus used, but with actual illustrations of the process itself. To those who have a taste for drawing, and who desire an easy method of multiplying their sketches, this process offers unusual advantages.

—If a new shaft shows any signs of a crack, heat it at the spot to a low red heat, and drop a few drops of water upon the doubtful spot; and if it is cracked it will show plainly a black line along the crack.

Making a Picture Without Being Able to Draw.

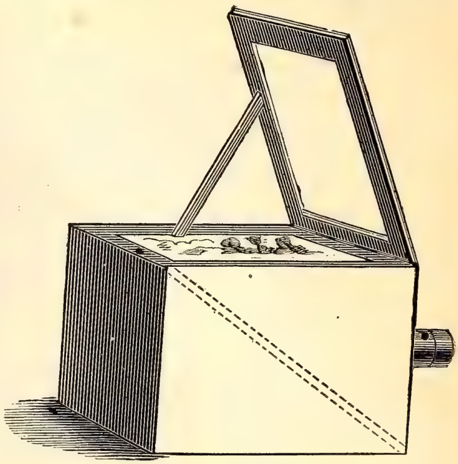
BY BENJAMIN HARTLEY.

THERE are many young persons who have not had the advantage of instructions in drawing, who yet have a taste for artistic pursuits, and would enjoy making pictures if only they could find some way to assist their uncultured eyes and hands. For the benefit of such we write this in the hope that some will be encouraged to try, and with the assurance, that if the advice given in this article is followed, will meet with considerable success.

Various means have been devised to overcome difficulties in the way of the youthful artist. The best assistant we think is a camera obscura, or sketching camera, as it is called. With such an instrument, used as we propose, almost any person might succeed in reaping very much of the pleasure to be derived from collodio etching without knowing the principles of drawing.

Like nearly everything else, the camera obscura may be a very plain, simple, inexpensive affair, or a very handsome and costly instrument. A boy scarcely twelve years old made one out of a thick pasteboard box and a common magnifying glass set in a pasteboard tube, which answered the purpose very well. We constructed one, some years ago, out of a starch box. This box was six by nine inches deep. Making a round hole in one end, a common single landscape lens, with tube from a small photographic camera, was inserted. The lid was taken out and a piece of a looking-glass, cut to fit, was placed inside, slanting downwards from back to front, so that the rays from the lens are reflected upwards. Now, in order to see the picture, we fitted a piece of ground glass in place of the lid. A light frame was next made and hinged to the top of the front, so as to fall backwards and cover the ground glass, and to this was tacked a large piece of black velvet, which was thrown over the head to exclude the light. This frame is supported on the left side by a stick screwed to the side of the box. A square box is better than an oblong one. All this can be easily understood by looking at the accompanying sketch. The dotted lines represent the mirror inside the box.

Suppose you have such an instrument, all you need to do is to put a prepared



plate, thinly varnished, on the top of the ground glass—varnished side up, of course—and trace the picture with a needle. If you wish to substitute the prepared plate for the ground glass, so as to get the image sharper and closer to your point, you must employ a varnish called "ground glass substitute," used by photographers. To this you must add about one-third more alcohol.

The picture thus made is reversed and ready for printing, and, besides, is a drawing *direct* from nature.

One thing more to be considered, and that is how to support the camera while working. For this purpose you will find a tripod the most convenient article. The camera must, in some way be fastened to the top, so as to remain perfectly still. Photographers use a bolt with screw and nut, but there are other ways of accomplishing the same object.

Messrs. Queen & Co. make and sell a little camera obscura with a tent, which is highly recommended for use by those unacquainted with drawing. By this instrument the picture is thrown down on a table inside the tent, and is sketched very easily, the principal trouble being the shadows cast by hand and pencil. It is not adapted to our purpose, however, as

we must have the light reflected from below the plate.

With the camera above illustrated and described, and a number of prepared plates, any one, with a little practice, can fill a day or a week at home or abroad, with profitable pleasure.

There are only two drawbacks to this practice: The first is the lack of artistic freedom. All you can do is to copy what is thrown on your plate; this can be overcome by an artist, but should not be attempted by any one else. The second disadvantage is in being unable in many instances to find a good standing place for the tripod, so as to get just the view you wish; but the great advantage of being able to etch your plate on the spot where a suitable place can be obtained, knowing that it is absolutely true to nature, will, in most minds, more than compensate for the disadvantages spoken of.

Let me, in closing, recommend the making of simple outlines first. A well-drawn outline is far better than a poorly-shaded picture, and can express a great deal more than is often imagined. After some practice in shading with a pencil, you can easily add it on your plates.

Frogs for the Aquarium.

BY A. W. ROBERTS.

NEXT to the young of the bull frog, the most desirable variety of the frog family for aquaria is the leopard frog, Fig. 1, which is generally acknowledged to be the handsomest of all our native frogs. In habit he is less aquatic than the bull-frog, often being found long distances from water; but in the spring of the year, during the breeding season, it remains near the water. The tadpoles of this frog cannot be distinguished from those of other frogs, and are, undoubtedly, more scarce; out of all the tadpoles of various kinds of frogs that I have raised, I never obtained a leopard frog, and from this I judge it is much less prolific than other varieties. I have known of large quantities of these frogs being taken in the winter time, in spring holes, for the New York Market. They are then in a semi-dormant condition, in which state they emit a decidedly strong, unpleasant, and pungent odor, but, when skinned and cooked, the odor disappears, and they are quite palatable. This is not so bad, however, as sending toads legs to the New York market, mixed up with a few frogs legs, and yet I have seen the remains of thousands of toads that had been slaughtered for this purpose.

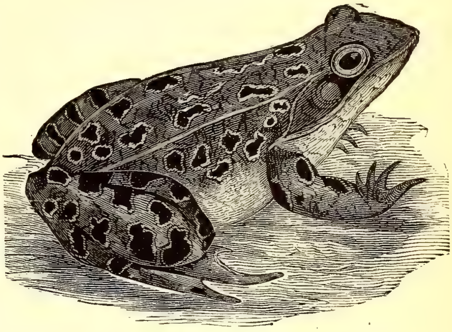


Fig. 1.—THE LEOPARD FROG.

The smallest of all frogs is the tiny tree frog, or Pickering's Hylodes, Fig. 2. This beautiful little reptile ought to be in the possession of every owner of an aquarium. A dozen to one tank of medium size is none too many. To keep these frogs in good condition in the aquarium, the surface of the water must be partially covered with bladderwort or duckweed, so as

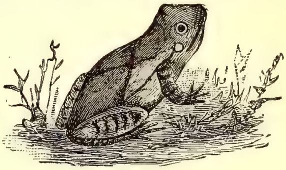


Fig. 2.—THE TREE FROG.

to afford them a resting place. The top of the tank must be provided with a close-fitting frame, on which is stretched fine netting, to prevent their escape. During the spawning season the voice of this frog is constantly heard along the margins of ponds, and consists of a shrill piping note. This piping they continue more or less through the summer season. In color they are changeable; and, as a rule, take on the colors of surrounding objects. When sick, or under the influence of

fever, they turn pale. When in repose, and resting on aquatic plants, they are of a dark greenish brown on the back, with two stripes of light green crossing near the middle; the sides are of a light green, vanishing into a yellowish white on the belly. Their toes are provided with soft membranous discs, by which they can adhere to any object, or climb a perpendicular surface. They are very delicate and easily killed. When collecting them, it is always best to place them in a separate vessel or compartment containing wet aquatic plants. They cannot live long in water, like other varieties of frogs, but are very easily drowned. I once had a tank containing over a hundred of these noisy little fellows, and it was very amusing to watch them, when piping, swell out their vocal organs to nearly the size of their bodies. Their favorite food was angle worms cut up fine, house flies, ants, and spiders.

Hints on the Use of Philosophical and Chemical Apparatus.

IT is, unfortunately, too true that most of our schools are destitute of the means of illustrating the principles which are set forth in our ordinary text books on chemistry and natural philosophy. At the same time it is also true that in every section of our country there may be found, connected with the public schools, sets of apparatus which are never used, or, if they are brought out at all, it is merely on distant occasions, and more for the purpose of complying with the requirements of trustees, etc, than of using them for purposes of solid instruction. This state of things cannot long continue. The impetus which has been given to the study of the physical sciences by the establishment of agricultural and industrial colleges, must sooner or later affect the instruction given in our public schools. Already, in this State, the privilege of free instruction at the Cornell University is held out to the students in our public schools as an inducement to a more diligent use of their opportunities; and, consequently, we may indulge a well-grounded hope that this fact will elevate the standard of education among us, as every boy will seek to place himself where he can receive the most thorough preparation for the competitive examinations which await him.

Another powerful influence will probably be found in the improvement which must sooner or later take place in our civil service. The cases are few in which success in the competitive examinations which must ere long be introduced amongst candidates for positions under government, will depend upon a knowledge of Latin and Greek. Modern languages, mathematics, and the physical sciences are the subjects to which attention must be given if success is to be obtained, and this not only from the direct use to be made of these studies, but from the iufluence which they exert upon the mind.

All these considerations must tend to impress upon the minds of teachers the necessity for thoroughly preparing themselves to take a part in the great work which is approaching. As a slight contribution to this most desirable object, we propose to give a series of articles containing hints on the use of philosophical apparatus, and the best methods of illustrating the principles of natural philosophy. These two subjects are entirely distinct, though often confounded. A lecture or a recitation may be illustrated by a series of experiments, brilliant in the extreme, and faultless in the neatness, accuracy, and success with which they are performed, and yet fail from the fact that the illustrations are either unappropriate or badly arranged—the last cause of failure being the more frequent of the two.

Upon the importance of physical illustrations in a course of scientific instruction it is unnecessary to speak. All successful teachers in this department know that an experiment which can be seen and heard will make an impression upon the minds of the pupils which cannot be equalled by any mere oral or written description. Just think of explaining such a simple matter as a thermometer to a class that had never seen one, and then consider the ease with which it can be done by exhibiting the instrument to

them. What is true of simple instruments is much more true of principles which depend upon unusual phenomena. It would be a very difficult matter to explain to a class the peculiar properties of oxygen or chlorine without illustrating these properties by experiments, and the properties of the air, such as its weight, elasticity, compressibility, etc., are but feebly apprehended by a class who have never seen these properties illustrated by experiments. Most teachers dread the performance of experiments for two reasons: Experimentation is always associated with the idea of "mussiness"—spilt liquids, clothes burned with acids, and general disorder, are, in their minds, the unfailing accompaniments of the performance of experiments. The second reason is the dread of failure.

Dread of failure can be overcome only by certainty of success. Let the teacher feel that the experiments which he is about to perform are *certain* to succeed, and that which was before a dread and an annoyance, will become a pleasure. Nothing is so disheartening as the failure of an experiment. Our whole course of teaching has been an effort to impress upon our students the uniformity of nature and the certainty of obedience to known laws; and now, when we come to test the matter, it is found that either nature is fickle or we do not understand her. The inference against the teacher is, in the minds of most pupils, irresistible, and, of course, it is natural that teachers should dread being placed in such a predicament. The way to avoid this is, not by shirking a duty, but by qualifying ourselves for the performance of it.

As to the first objection, it should be understood that disorder is one of the most efficient causes of failure. Show us an experimenter whose table is in a "muss;" who spills his liquids, knocks over his apparatus, and disturbs his previous arrangements, and we will show you one to whom failure is no stranger. We have now in mind a teacher who often appears upon the lecturer's rostrum, surrounded by apparatus. He, in general, asks and receives very little assistance from those around him. He performs his own experiments, and yet we have seen him, at the close of a lecture involving the use of batteries, jars of liquids and gases, hot acids, furnaces, etc., with scarcely a speck upon his person or a stain upon his clothes. No spilling or overturning with him. He seems to move about among his apparatus as if it were part of himself, and while his lips are giving the most beautiful explanations of physical phenomena, his hands are busily employed in illustrating them. It is needless to say that such an experimenter is "uniformly" successful.

Careful study of the principles involved in the experiment to be performed, combined with a little *private* practice in the necessary manipulations, will soon place any intelligent young man or woman above all dread of failure, and when this is the case, experimenting becomes a pleasure instead of an annoyance.

Cheap Lathes and How to Use Them. IV.

CHOICE OF A LATHE.

THE framing next demands attention. See that it is firm and without shake. If the different pieces can move on each other it will be impossible to do good work. Of course, when the bed or shears are made of one solid piece of metal, all shake of this kind is impossible, so far as this part is concerned, but in the lathes with wooden shears, which consist of two pieces lying parallel with each other, and held together at the ends by means of bolts and screws, it sometimes happens that the bolts get loose, and then there is trouble. Some kind of lock nut would be the best remedy for this. A lock nut is one which, after being screwed up, is *locked*, so that it cannot be unscrewed without special means for loosening it. As these bolts rarely, if ever, require to be taken out after they are once in place, a good plan is to slightly rivet them if they should ever get shaky.

Although metal shears, cast in one piece, cannot get shaky themselves, they are frequently fixed to the frame in such a way as not to be very firm. The top of the frame or support should be broad, and

the fit between it and the shears or bed should be good, otherwise it will be impossible to prevent chattering.

The heads should stand upon long bearings. A bearing of an inch or two is too much like a point, and the back head will be very apt to rock unless the bearing is long.

The back head-stock should fit accurately between the ways or shears, if this is the manner in which it is attached. Of course, where the head-stocks slide on Vs, there is no danger of getting the centres out of line; but if the back head or poppit slides on smooth ways with a tongue dropping down between them for the purpose of guiding it, unless this tongue fits accurately between the shears, the head may easily be skewed round so that the centres will not be in line.

We have already spoken of the spindle and of the necessity for its running true. In order that it may run steadily, it should have considerable length between the bearings.

Some of the cheap lathes in market are wonderful specimens of fancy work, being gilt and painted to an extraordinary degree. Avoid all such. See that the article you purchase is well made and simply finished, but avoid all gewgaws and frippery.

Chucking Work on the Lathe.

BY JOSHUA ROSE, M.E.

WORK held in a lathe otherwise than by being suspended between the lathe-centers, is what is termed chucked. The simplest method of chucking is with a strap—that is a plate of iron bolted across the work. Suppose, for example, that it is required to turn out the hole, A, in Fig. 1, it would if a small piece be placed

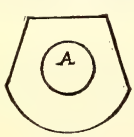


Fig. 1.

against the lathe face-plate, B, in Fig. 2; a plate of iron, C, placed over it, and the bar, D, forced against C by the back or dead centre of the lathe, to hold the work up against the lathe face-plate while chucking it.

Figure 3 shows how the chucking is done. A is the work, B the lathe face-plate, and C the plate or clamp holding

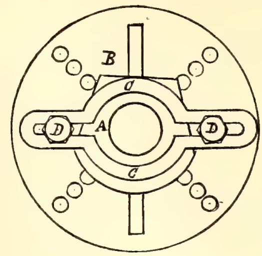


Fig. 2.

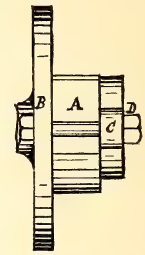


Fig. 3.

the work to B by means of the bolts, D D. An excellent example of chucking by plates is a crank, say for a model steam-engine, such as shown in Fig. 4. In this

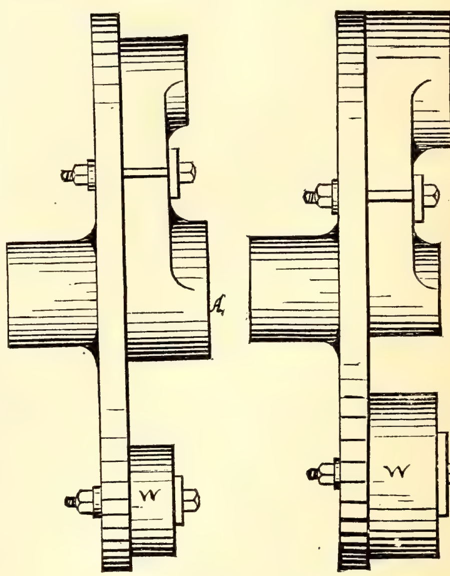


Fig. 4.

case the plate is out of the way, so that the face, A, can be turned as well as the hole bored, hence the face is sure to be true with the hole. The pieces, W, are balance weights to counterpoise the work on the face-place.

Sometimes a projection, such as B, in Fig. 5, prevents the work from going up against the face-plate, and parallel pieces

of iron, A, D, E, are put behind the work, directly beneath the holding plates or

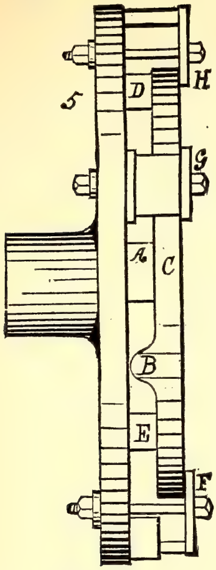


Fig. 5.

clamps, H, F. It should be noticed that the heads of the bolts are outwards; this is because it is difficult to get bolts of just the right length for a piece of work, and

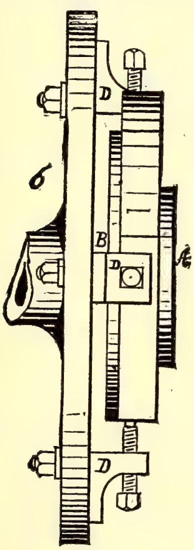


Fig. 6.

it does not matter how far the ends of the bolts project *behind* the face-plate.

If a piece of work requires turning on both radial faces, it is held off the face-plate by what are termed dogs, which are shown at D D, in Fig. 6.

Care of Gold Fish.

In a recent issue of *Vick's Monthly*, Seth Green, whose reputation as a fish culturist is world-wide, gives the following directions for keeping gold fish:

I will tell Miss Nettie how to care for her gold fish. The cause of the fungus growing on the fish is that the slime or scales of the fish had become rubbed off, either by handling or by some other means. If you wish to move your fish from one vessel to another, you should use a net made of some kind of thin, soft material—mosquito netting or an old veil will answer. They should never be taken in the hands. You may not have handled them, but some one else may have done so, either before or after you purchased them. The only cure I know of for the white fungus, is to make a strong brine of common salt and put the fish into it for a minute or two, then immediately put them back into fresh water. Do this three times a day. If you commence doing this when you first discover the fungus growing on them, you will sometimes cure them. When you have healthy fish, keep them well by changing the water every time they come to the top and keep opening their mouths, and seem to be breathing more air than water. When you change the water do so by taking about one-half out at a time and replacing it with fresh—a full change is very apt to prove injurious. Give them plenty of food, such as angle-worms, or any kind of insects, or fresh meat cut into small pieces; fish-wafer is also good. They should have a change of food every week or so.

If you have no plants in your aquarium, I would advise putting in a little fresh earth as often as once a month, and leaving it for two or three days. There should be no food left in the water after it is ten hours old, as decaying meat taints the water the same as it would the air. A fish's nostrils are more sensitive to bad odors than Miss Nettie's, but she would

have the advantage of the fish, being able to run away, whereas, the fish, enclosed in a small aquarium, must stay and take it as it comes.

Now, Miss Nettie, I want you to make a study of your fish, and you will soon learn when anything ails them; you will learn by their actions that something is wrong, and will know it as sure as you know when your own head aches, and if you are as prompt to do something for your fish as you are to do something for your head, your fish will thrive much better. I have a daughter who keeps gold fish for years.

Magic as an Aid in Civilization.

PROBABLY the only instance in modern times in which a conjuror has been called upon to exercise his profession in the employment of Government, was that of Robert Houdin. He was sent to Algeria by the French Minister of Foreign Affairs to exercise the black art in that benighted country, hoping thus to destroy the influence exercised among the Arabs by the Marabouts—an influence which was often mischievously applied. By a few cunning, yet clumsy tricks, these Marabouts passed themselves off as sorcerers, and were held in fear and veneration by the ignorant tribes. The French Government desired to show the Arabs that these would-be leaders among them were mere impostors, and that their pretended supernatural powers were without the least foundation in truth. The best way to do this, it was thought, would be to send one among them who should eclipse their skill, and thus discredit their science and pretended powers. It was resolved to send Robert Houdin, and the wizard was ordered to appear at the Government office in Paris forthwith.

Houdin was a little puzzled to know what the minister could want with him. The plan and purpose of the government were made known to him, and he entered with spirit into the idea and its successful application. With every facility and all needed protection, Houdin sailed for Algeria to astonish the natives. This he succeeded in doing by means of a few striking tricks, of which we shall give a full explanation in our next.

Arriving under favorable auspices, he went at once to work upon the object of his mission, and gaping crowds followed him everywhere, thinking him inspired. He succeeded in showing the people that he could vanquish the famous prophets, who had obtained such control over the ignorant masses of the population, and thus threw them into such discredit that he succeeded in disarming them almost entirely of their influence.

Still, there was one of the Marabouts whom he had not yet met, and who scoffed at the reported powers of this French wizard. A day was therefore appointed when the two should appear before the people, and each give evidence of his own peculiar powers.

One of the great pretensions of the Marabout was to invulnerability. At the moment that a loaded musket was pointed at him and the trigger pulled, he pronounced a few cabalistic words and the weapon would not go off. Houdin instantly detected the trick, and showed that the touch-hole of the musket was carefully plugged. This rendered the Arab conjuror furious, and he, of course, abused his French rival without mercy. Houdin was perfectly cool, and, turning to him, said: "You are angry with me."

"I am," said the Marabout.

"And would be avenged?"

"Yes," he replied, regarding Houdin with eyes gleaming with ferocity.

"It is very easy."

"Show me the way."

"I will show you," said Houdin, quietly, while the Arab was all attention.

"Take a pistol; load it yourself. Here are bullets. Put one in the barrel. But stop—"

"For what?" said the Arab.

"Mark the bullet with your knife, that you may know it." The Arab did as he was told.

"You are quite certain now," said Houdin, "that the pistol is properly loaded."

"Yes."

"Tell me, do you feel no remorse in killing me thus, even though I consent?"

"No!" and the eyes of the savage grew darker with an expression of cruelty.

"It is strange," said Houdin, almost sadly.

"You are my enemy, and I will kill you," he replied.

"Wait but a moment."

Houdin then stuck an apple on the point of a knife, and calmly gave the word, as he held the fruit raised in one hand, "Fire!"

The pistol was discharged, the apple flew far away, and there appeared in its place, stuck on the point of the knife, the bullet which the Marabout had marked. The spectators, though aroused to intense excitement of feeling, remained mute with stupefaction, while the Marabout bowed before his superior, saying:

"God is great! I am vanquished."

Great was the triumph of the French wizard.

Houdin then called for an empty bowl, which he kept constantly full of boiling coffee, though but few of the Arabs would taste it, for they were sure that it was the evil one's coffee pot from whence it came. He told them that it was within his power to deprive them of all strength and to restore it to them at will, and he produced, in illustration, a small box, so light that a child could lift it with the fingers.

And now came their astonishment.

This box suddenly became so heavy that the strongest man could not raise it, and the Arabs, who prize physical strength above everything, looked with terror upon the magician, who, they doubted not, could annihilate them by the mere exertion of his will.

The people expressed this belief, in which the wizard, of course, confirmed them, and promised that, at a day appointed, he would convert one of them into smoke. The day came and the throng was prodigious. A fanatical Marabout had agreed to give himself up to the French sorcerer for the experiment.

The preparations were on a grand scale. The Marâbout was made to stand upon a table, and was covered with transparent gauze. Then Houdin and another person lifted the table by the ends, when the Arab disappeared in a profuse cloud of smoke. The terror of the spectators was indescribable. They rushed out of the place and ran a long distance before the boldest could make up their minds to return and look for the Marabout. They found him near the spot where he had so mysteriously disappeared, but he could not answer their questions; he could tell them nothing at all, and only gazed wildly at them like one bereft of his senses. He was entirely ignorant of what had happened to him.

This was Houdin's closing exhibition in Arabia. The minds of the people had been filled with wonder, and he was venerated by all, while the pretentious Marabouts were in utter disgrace.

Cast a Line for Yourself.

SOME people are lazy, and do not work as much as others, but strive to get what others have. The following incident, which occurred in an eastern State, between a man and a boy, is a very good example of the above.

A young man stood listlessly watching some anglers on a bridge. He was poor and dejected. At last, approaching a basket filled with wholesome looking fish, he cried, "If, now, I had these, I would be happy. I could sell them at a fair price, and buy nice food and lodgings."

"I will give you just as many, and just as good fish," said the owner, who chanced to overhear his words, "if you will do me a trifling favor."

"And what is that?" asked he eagerly.

"Only to tend this till I come back; I wish to go on a short errand."

The proposal was quickly accepted. The old man was gone so long that the young man began to be impatient. Meanwhile the hungry fish snapped greedily at the baited hook, and the young man lost all depression in the excitement of pulling them in, and, when the owner of the line returned, he had caught a large number.

Counting out from them as many as were in the basket, and presenting them to the young man, the old fisherman said: "I fulfil my promise from the fish you

have caught, to teach you, whenever you see others earning what you need, to waste no time in fruitless wishing, but 'to cast a line for yourself.'"

Whistling to a Squirrel.

ONE afternoon last summer, when out looking for game, I sat down on a pile of rails to rest. Pretty soon I discovered in an oak tree, some twenty yards away, a red squirrel stretched at full length on a limb taking a sun bath. Instead of raising my rifle and sending a ball through the little fellow (it's a mighty mean "sportsman" that endeavors to kill all he sees) I decided to give him a little pleasure if I could, so I commenced to whistle the air of that once popular ditty, "I love Thee, Sweet Norah O'Neil." In a twinkling the squirrel was up on his hind legs, his tail over his back, his head cocked to one side, listening to me; a moment of irresolution, and then he scampered down the trunk of the tree to the ground and started towards me; he came a few yards, stopped, sat up on end and listened again. I was careful not to move, and kept on whistling; after waiting a moment, the little beauty came on, jumped up on the pile of rails, ran along within four feet of me, halted, went up on end again, made an umbrella of his tail, tipped head to one side, looked at me with all the gravity of a justice of the peace at his first trial, and yet if ever a creature's eyes beamed with pleasure, his did.

I did not move, but after a little I abruptly changed the tune to the "Sweet By and By." Chut! Why, with the first note of the different tune away went the squirrel. I did not move, only I shook with suppressed laughter, and, as well as I could, kept on whistling. In a minute or two back came the squirrel, going through all the cunning manœuvres of his first approach, and once more took a seat before me on the rails. I watched him, and actually thought he was trying to pucker up his mouth and whistle.

Once again I changed the tune, this time to "Yankee Doodle," and, as before, with the first note of change away scampered the squirrel. Unable to control my risibilities longer, I laughed aloud, and after that I couldn't call my little friend to me.

I wonder how many of the so-called "true sportsmen" ever seek or think of any pleasure in connection with such beautiful little creatures, save the savage and unmanly pleasure of taking away their lives.—*Forest and Stream.*

Common Telescopes.

THE following description of common telescopes, and what may be done with them, is from the advance sheets of Webb's "Celestial Objects for Common Telescopes." The new edition is nearly ready, and will be eagerly sought for by all amateur astronomers.

By "common telescopes" are here intended such as are most frequently met with in private hands; achromatics with apertures* of 3 to 5 inches; or reflectors of somewhat larger diameter, but, in consequence of the loss of light in reflection, not greater brightness.† The original observations in these articles were chiefly made with such an instrument—an achromatic by the younger Tulley, 5½ feet in focal length,‡ with an aperture of 3 7-10 inches, and of fair defining quality; smaller instruments, of course, will do less, especially with faint objects, but are often very perfect and distinct; and even diminutive glasses, if good, are not to be

* "Aperture" always means the clear space which receives the light of the object; the diameter of the object-glass in achromatics, or the large speculum in reflectors, exclusive of its setting.

† Maskelyne estimated the apertures of metallic reflectors and achromatics of equal brightness as 8 to 5. Dawes gives this value for Gregorians, but, like Herschel II., rates Newtonians as 7 to 5. Arago strangely asserted that no light was lost in achromatics; but the effects of absorption and reflection are so considerable, that with very large apertures the advantage of the achromatic disappears. The silver-on-glass specula, invented by Foucault and Steinheil, but perfected in England, take their place between the metal Newtonian and the achromatic, approaching more nearly to the latter, especially when the plane mirror is replaced by a prism (which, however, does not always conduce to critical definition). Buffham assigns equal light to silvered Newtonians of 9, 6⅛ and 4½, and achromatics of 8, 5¾, and 4 inches respectively.

‡ The focal length is measured from the object-glass, or speculum, to the spot where the rays cross and form a picture of the sun or any celestial body.

despised; they will show *something* never seen without them. I have a little hand telescope, 22¼ inches long when fully drawn out, with an object-glass of about 14 inches focus, and 1 1-3 inch aperture: this, with an astronomical eye-piece, will show the *existence* of the solar spots, the mountains in the Moon, Jupiter's satellites, and Saturn's ring. Achromatics of larger dimensions have become much less expensive than formerly, and silvered specula of very considerable size are now comparatively common; even for these it is hoped that this treatise, embodying some of the results of the finest instruments, may not be found an inadequate companion as far as it goes.

In judging of a telescope, we must not be led by appearances. Inferior articles may be showily got up, and the outside must go for nothing. Nor is the clearness of the glass, or the polish of the mirror, any sign of excellence: these may exist with bad "figure" (*i.e.*, irregular curvature), or bad combination of curves, and the inevitable consequence, bad performance. We need not regard bubbles, sand-holes, scratches, in object-glass or speculum; they merely obstruct a very little light. Actual performance is the only adequate test. The image should be neat and well defined with the highest power, and should come in and out of focus sharply; that is, become indistinct by a very slight motion on either side of it. A proper test-object must be chosen; the Moon is too easy; Venus too severe, except for first-rate glasses; large stars have too much glare; Jupiter or Saturn are far better; a close double star is best of all for an experienced eye; but for general purposes a moderate-sized star will suffice; its image, in focus, with the highest power, should be a very small disc, almost a point, accurately round, without "wings,' or rays, or mistiness, or false images, or appendages, except one or two narrow rings of light, regularly circular, and concentric with the image;* and in an uniformly dark field; a slight displacement of the focus either way should enlarge the disc into a luminous circle. If this circle is irregular in outline, or much brighter or fainter towards the centre,* or much better defined on one side of the focus than the other, the telescope may be serviceable, but is not of high excellence. The chances are many, however, against any given night being fine enough for such a purpose, and a fair judgment may be made by day from the figures on a watch-face, or a minute white circle on a black ground, or the image of the sun on a thermometer bulb, placed as far off as possible. An achromatic, notwithstanding the derivation of its name, will show color under high powers where there is much contrast of light and darkness. This "outstanding" or uncorrected color results from the want of a perfect balance between the optical properties of the two kinds of glass of which the object-glass is constructed; it cannot be entirely remedied, but it ought not to be obtrusive. In the best instruments it forms a fringe of violet or blue round luminous objects in focus under high powers, especially Venus in a dark sky: A red or yellow border would be bad; but before condemning an instrument from such a cause, several eye-pieces should be tried, as the fault might lie there, and be easily and cheaply remedied. Reflectors are delightfully exempt from this defect; and as now made, with specula of silvered glass, well deserve, from their comparative cheapness, combined with admirable defining power, to regain much of the preference which has of late years been accorded to achromatics. The horizontal view of objects at all altitudes in a Newtonian reflector with rotating tube is extremely pleasant, when a little experience has been gained in finding and following; the same advantage, however, attends the use of a diagonal eye-piece with the

The real diameter of a star in the telescope would be inconceivably small. The apparent or "spurious" disc, and rings, result from the undulatory nature of light. They seem, however, to be somewhat affected by atmospheric causes. Herschel II. speaks of nights of extraordinary distinctness, in which "*the rings are but traces of rings*, all their light being absorbed into the discs." I have entered 1852, March 23, as "a very fine night, though the rings and appendages around the brighter stars were rather troublesome;" 1852, April 1, "an exceedingly fine night at first, with scarcely a trace of rings or appendages." See also the star 70 Ophiuchi.

*The small mirror in a reflector causes a central darkness out of the focus, which should be nearly the same on either side of it.

achromatic, but with loss of light. The chief disadvantage of reflectors is the greater aperture, and consequently greater atmospheric disturbance, corresponding with the same amount of light; and the occasional renewal of the film causes a little expense or trouble.

The eye-piece, or ocular, is only a kind of microscope, magnifying the image formed in the focus of the object-glass or speculum. The size of this image being in proportion to its distance from the glass or mirror which forms it, the power of the same eye-piece in different telescopes varies as the focal length. Hence the disadvantage of a short telescope; to get high powers, we must employ minute and deeply-curved lenses, which are much less pleasant in use; with a telescope twice as long, half the curvature in the eye-piece produces an equal power. The magnified focal image, as in the camera, is always inverted, and so in the astronomical eye-piece it remains.* For terrestrial purposes it is erected by two additional lenses; but a loss of light is thus incurred, and as the inversion of celestial objects is unimportant, erecting eye-pieces (always the longest of a set) should never be employed for astronomy; the eye soon becomes accustomed to the inverted picture, and the hand to the reversed motion in following the object. The lateral vision in the Newtownian reflector interposes another difficulty, easily mastered, however, by practice, and by attention to the direction of motion through the field. A multitude of eye-pieces is needless, but three at least are desirable; one with low power and large field, for extended groups of stars, nebulæ, and comets, supplying also, if necessary, the place of a "finder" for deep magnifiers; a stronger one for general purposes, especially the moon and planets; and a third, as powerful as the telescope will bear, for minute objects, especially double stars. A greater number of eye-pieces admits, however, of what is often important—an adaptation of the power to the brightness of the object. Ordinary astronomical eye-pieces are shorter in proportion to their power. It is a better plan to change them by means of a short tube, or "adapter," than by a screw; in which case they are more liable to be dropped and injured.

The power may be much increased by unscrewing and and taking away the "field-lens"—that farthest from the eye; but the centre of the field only will be distinct. The highest powers of large telescopes are sometimes made thus, with single lenses for the advantage of light; but the lens is then turned the other way, convex towards the eye, as it gives sharper vision. Sir W. Herschel used the double convex form, as having shallower curves. The common kind, with two lenses, having the flat side of each next the eye, is called the Huyghenian or negative eye-piece: the positive or Ramsden eye-piece has a flatter field, but is not, like the other, achromatic. The interposition of a combination called a Barlow lens raises the power with little loss of light; and as one may be made to suit all the eye-pieces, it doubles the set at a small expense. Brownings's achromatic eye-piece, and Horne and Thornthwaite's aplanatic, and the Kellner construction (for large fields) are all excellent in their way. The brightness of the field varies inversely as the square of the power: and hence minute stars are commonly more visible with deep eye-pieces; the reverse, however, for some unknown reason, sometimes occurs.

If the power of our oculars has not been engraved upon them,* we may get a fair approximation to it by viewing an equally divided scale at a distance (for low powers, a brick wall will answer) with one eye through the telescope, and with the other alongside of it, and noting how many unmagnified divisions are covered by a single magnified image. Or, better still, we may have recourse to the Berthon Power-gauge, a little apparatus, the simple, efficient, and inexpensive character of which entitles it to very warm comendation.

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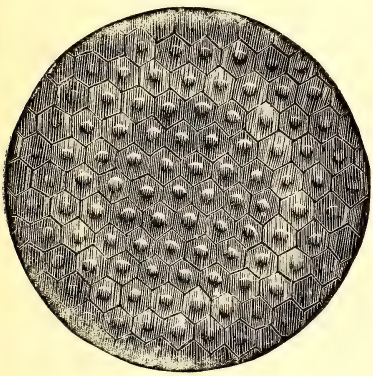
*It is erect in the Galilean eye-piece and the Gregorian reflector. But the use of the former is almost confined to opera-glasses, as its field with high powers is exceedingly small; and the latter, an inferior construction, is now little employed.

* These figures are not, however, always to be depended upon, and must be wrong if the eye-piece was made for an instrument of a different focal length. The celebrated Short exaggerated the powers of his reflectors; and those of the great achromatics of Dorpat and Berlin were found by Struve and Encke to be overrated.

How a Fly Sees.

AMONGST the objects which are to be found in every little collection is the fly's eye, so called. On placing it under the microscope, and bringing it into focus, so as to get a clear view, we see an object like a piece of netting, with six-sided meshes. And to most persons this is the end of the fly's eye. They are told that each mesh is a veritable eye, and they believe it, because they have faith in what scientific men tell them. But they have no clear ideas on the subject. If we look at the head of a fly, and particulary that



EYE OF FLY.

of a large blue-bottle or a dragon fly, we shall see that it consists chiefly of two large round lumps, which, under a good magnifier, are seen to be covered with facets, each one of which is an eye, and it is these eyes that under the compound microscope are seen as the meshes of the apparent net. Each one of these eyes transmits a picture or image of all surrounding objects within their scope, but it does not thence follow that the fly sees a thousand faces any more than that we see all objects doubled when we look at them with our two eyes.

To prove that each of these facets is a distinct eye is not a very difficult matter. Those who have good microscopes and a little experience, find no difficulty in showing an image of any object in each facet, so that the whole field of view is filled with little pictures of whatever object may be selected. The most striking object is perhaps a watch face with the second hand in motion. We then seem to see a thousand watch faces, in each of which the seconds are ticked off with the most perfect harmony. To show the watch face clearly requires strong illumination and good definition. In any case, however, the proper illumination of the object is the chief point necessary to secure success. Therefore, it will be found that the easiest object on which a beginner can try his hand is the flame of a lamp or candle. Arrange the microscope in an inclined position, with a 2-3 or 1-2 inch objective, and place a candle or taper below the stage, and about two inches from it. If the microscope be sufficiently inclined the heat and flame will cause no annoyance. The lamp must be in the direct line of the optic axis of the microscope; that is to say, a line passing through the centre of the body of the microscope ought to pass through the flame of the candle. The fly's eye, if now placed on the stage, will be illuminated and may be focussed so as to show the meshes clearly and sharply. If we now move the objective away from the object we will find, after a little while, that we have a distinct view of the flame of the candle in every mesh or facet, and if a breath of air should stir the flame, the hundreds of little flames seen in the field of view will move in precisely the same direction and at the same time.

This is one of the most interesting and instructive microscopical experiments that we know of, and if the reader will study the conditions of success by a little experimenting, he will soon be able to give good exhibitions of the most difficult subjects.

Scientific Amusement.

UNDER this head we propose to give a series of articles containing directions for performing simple but striking experiments in various branches of science. In selecting experiments for this department great care will be taken to choose those only which are entirely free from danger, either to the person,

the clothing, or the furniture, and which are so easily performed that any boy or girl who has a taste for such things need fear no risk of failure.

All the experiments which we shall describe may be performed by means of such ordinary articles as may be found in every household, with the exception of a few pieces, which may be made by any village carpenter or blacksmith, or may be bought for a few cents. We shall give most minute directions for making every piece of apparatus that is used, well-knowing that an experiment which is performed by means of things which we ourselves have got up is far more interesting than those of much greater brilliancy and beauty, which are performed by means of apparatus that has been purchased.

One of the most striking circumstances connected with chemical action is the change which it produces in the condition of bodies. Thus a bar of solid iron, which seems to the ordinary mind one of the most substantial of objects, may be dissolved and rendered not only quite invisible, but imperceptible to the touch. The same is true of a mass of lead or silver, and the following experiments which illustrate this are at once simple and striking.

TO CHANGE A PIECE OF STEEL TO COPPER.

Take a strong solution of sulphate of copper, or blue vitrol, as it was called in olden times, and dip into it a piece of clean and bright iron or steel, such as the blade of a knife. If the surface of the metal is perfectly clean, and, in particular, free from grease, it will, in a few minutes, be *changed* to copper. We use the word "changed" advisedly, for the iron is actually dissolved and the copper takes its place.

A somewhat striking modification of this experiment may be performed as follows: Have a flat piece of polished iron, such as a knife blade, perfectly free from grease, and a sponge or wad of rags soaked in a strong solution of sulphate of copper, to which a very little tartaric acid has been added. On rubbing the iron with the sponge it will be instantly changed to copper.

Song of the Frog.

BY MARY H. WHEELER.

Brothers, brothers in the mire,
Long-tailed tadpoles, frogs entire,
Come up from the mud below!
Hark, again the waters flow!
Hibernating days are o'er,
We may swim and sing once more.

Brothers, brothers, hear my call!
Come up quickly, one and all!
On the banks of pools o'erflowing,
Green, oh! green the reeds are growing,
And the zoospores, set free,
Whirl around and round in glee.

Brothers, lo! the days are long,
Time it is to raise our song!
Twilight, ling'ring in the bogs,
Listens for the voice of frogs.
Shall fair Spring commence her reign
Unannounced by our refrain?

Brothers, of Batrachian race,
From great sires our blood we trace!
But alas! for glory gone
With the labyrinthodon!
Ah! *his* singing was no joke,
Now we only croak and croak.

Brothers, brothers, our hearts still
Feel the great ancestral thrill!
This is why in our veins flow
Blood discs of such size, you know.
But the fugue we sing so late,
Is for race degenerate.

Pittsfield, N. H., April, 1881.

Polishing Vulcanized Rubber.

Remove scratches with a smooth, wet water-of-Ayr stone, and then polish in the lathe with fine pumice and a stiff brush. After washing the pumice off, polish it with whiting and soft brush. The mathematical instrument makers treat it as brass; that is, for flat work they use water-of-Ayr stone, and then rottenstone and oil. Turned work is polished in the lathe with rottenstone and oil, taking care not to use too high a speed, which would heat the work. Some use lampblack and oil to finish with where a very high polish is wanted, or the bare palm of the hand, as in getting up silver plate. Chain and ornament makers use circular buffs for their flat work, made out of sea-horse leather, and for work of irregular forms, buffs of calico. A number of pieces, 12 inches in diameter, are screwed together between flanges, like a circular saw spindle, and used wih rottenstone, always taking care not to heat the work; brushes are not at all suitable for it.

Chrome Ink.

The following recipe is said to have been carefully tested and to have given excellent results: Twenty-four parts of solid commercial extract of logwood, one thousand parts of water, and two parts of yellow chromate of potash; or for a pint of water (a pound, or seven thousand grains), one hundred and sixty-eight grains of the logwood, and fourteen grains of the chromate. Dissolve the logwood in boiling water, filter it, and when cold add the chromate. A little carbonate of soda (a few grains) may be added to prevent the decomposition, which, according to some authorities, is liable to take place in the fluid on exposure to the air. No gum is to be used, as it is not only unnecessary, but injurious. The proportions must be exactly followed, especially in regard to the chromate, any excess of which is unfavorable to the perfection of the ink.

This fluid is of a deep blue-black color when first used, does not corrode steel pens, adheres so firmly to the paper that it may be washed with a sponge or left for hours under water without being dissolved out, and is not easily removed by ordinary chemical agents. It is also one of the cheapest inks that can be made.

Instead of the solid extract of logwood, a saturated solution of logwood may be used (made by boiling the wood in water), but the former, which may be bought of any dealer in drugs and dyestuffs at about twenty cents a pound, is much more convenient.

A Persistent Blue-Bird.

Ed. Young Scientist—One day last summer a male blue-bird came to my window and demanded admission by knocking against the window with his bill, and, as soon as the window was opened, he would fly on the sill and warble a few notes, and then fly away, this he continued for two or three weeks, when he suddenly disappeared, and we saw nothing of him till two or three weeks ago, when he suddenly appeared, and since that time has kept up almost a constant knocking on the windows. I cannot possibly imagine what he wants, except to hide his nest from the English sparrows, which are very numerous here.

ALEXANDER G. GIBBS.

A Powerful Light.

The Brush Electrical Manufacturing Company, at Cleveland, Ohio, has recently manufactured for use in the British navy, an electric light, which has been tested and found to have a 100,000-candle illuminating power—a power 50 times greater than the ordinary electric lamp for street lighting. This is believed to be the largest and most powerful light ever made with human hands. It is designed to be used in night attacks, and to scrutinize the sea for torpedoes. A 40-horse power engine is required to produce the light. The carbons used are two inches and a half thick. The intense heat generated between the carbon points is half a million degrees, one-ninetieth the estimated heat of the sun. It is calculated that with an ordinary reflector a beam of light will be cast so powerful that a person 15 miles away can see to read by it.

Practical Hints.

Pearls.—Set pearls, which have become discolored by wear, may often be improved by placing in a covered vessel with a mixture of whiting, ammonia and water, and permitting them to remain a few hours.

Polishing Powder.—A good powder for cleaning jewelry, silver watch cases, etc., is made by mixing about four parts of whiting with one of rouge, using with alcohol or water; this, it will be found, is easily brushed out of crevices, engravings, etc.

To Solder Tortoise Shell.—Bring the edges of the pieces of shell to fit each other, observing to give the same inclination of grain to each; then secure them in a piece of paper, and place them in hot irons or pincers; apply pressure, and let them cool. The heat must not be so great as to burn the shell; therefore try it first on a white piece of paper.

Liquid Cement.—Equal parts of compound tragacanth powder and powdered gum acacia, (gum arabic,) moistened, according to requirements at the time, with dilute acetic acid, or, if the color will not be of any importance, with ordinary vinegar. This cement is recommended as superior to any that can be bought ready made.

India Rubber Cement.—A good cement, that will render india rubber in any form adherent to glass or metal, may be made as follows: Some shellac is pulverized, and then softened in ten times its weight of strong ammonia, whereby a transparent mass is obtained, which becomes fluid after keeping some little time, without the use of hot water. In three or four weeks the mixture is perfectly liquid, and, when applied, it will be found to soften the rubber. The rubber hardens as soon as the ammonia has evaporated again, and thus becomes impervious both to gases and to liquids. For cementing the rubber sheet, or the material in any shape, to metal, glass, and other such surfaces, the cement is strongly recommended.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business letters or cards they cannot be used.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

To exchange for offers; a small lot of microscopic mounting apparatus. List on application to J. N. B., Box 1468, N. Y.

To exchange, books and YOUNG SCIENTIST, and trinkets, for other books, revolver, or stylographic pen. Frank Bicknell, Humboldt, Iowa.

Ancient petrified grain, Indian pottery, birds eggs, papers, magazines, Confederate money, fossils, minerals, to exchange for arrow-heads, Indian relics, Confederate, Continental, and other paper money. Fred T. Brinkerhoff, Box 347, Neenah, Wis.

Minerals, tricks, copper coins, book on pigeons and rabbits, Wilson School History, for book on experiments, or specimens, minerals, stamps or coins. P. R. Bradley, Box 305, Dunkirk, N. Y.

Wanted, a second-hand screw cutting foot lathe, must be in good condition; state what is wanted in exchange, also size and make of lathe. G. A. Clark, Castalia, Iowa.

To exchange, minerals, shells, fossil shells, birds eggs, etc., for minerals, shells, fossils, stuffed birds, birds eggs, and books. U. S. Grant, Des Moines, Iowa.

Wanted, botanical correspondents for the coming season, also amateur correspondents in chemistry. L, Box 70, East Templeton, Wov. Co., Mass.

Wanted, to exchange a well-equipped job printing outfit, for books or offers. Frank A. Niblack, Rockport, Ind.

Will exchange for Vol. 2 of the YOUNG SCIENTIST, instructive books bound in cloth to the value of $1.50. Chas. H. Williamson, 293 Eckford St., Greenpoint, Brooklyn, N. Y.

I have a new Munsen's battery, large size, which I wish to exchange for a good revolver or offers. Robt. T. Boyle, 351 West 83d St., New York.

Hair of American deer to exchange for diatoms, foraminifera, or other material. W. H. Osborn, Chardon, Ohio.

To exchange, full instruction in short-hand writing, and birds eggs, for birds eggs, postage stamps, or offers. M. F. E., 51 Spencer St., Albany, N. Y.

"History of Our Country," by Lossing, in six parts, price $15, to exchange for printing press or offers. Frank Chandler, Waverley, Mass.

Fine Devonian and Carb. fossils for others, especially cretaceous fossils, scientific books or papers; Pitman's short-hand works for books or offers. A. Stapleton, East Point, Tioga Co., Penn.

Wanted, scientific books and apparatus; send lists and say what is wanted in exchange. Ewing McLean, Greencastle, Ind.

Wanted, specimens in geology, entomology, oology, etc., for those in other localities, also coins and a charm microscope (magnifies 1,000 times) for one having a different view. J. H. Jones, Frankfort, N. Y.

Send for exchange list of insects, especially Coleoptera and Lepidoptera. Philip Laurent, 621 Marshall St., Philadelphia, Pa.

For printing press or offers, achromatic telescope, $8.50; microscope, $5; set drawing instruments, $3; revolver, $3; Phrenological Journal, $2.50; books, 12 plays, farces, dramas, burlesques, etc., $1.80. F. E. Payne, Alma, Mich.

One pair 3 lb Indian clubs, one scroll saw, one pocket lantern, and a large number of books, for magic lantern, pair telephones, photographic camera, or offers. Thos. A. Black, Lock Box 678, Scranton, Pa.

For exchange, pocket lantern and instruction books for cornet and clarionet; wanted History of the "Franco-Prussian War," and the "Lost Cause." C. W. Hughes, Shreve, Wayne Co., Ohio.

I have Brown's heavy scroll saw attachment, worth $6, which I wish to exchange for a lathe chuck or offers. C. B. Russell, Waterbury Centre, Vt.

Will exchange magnets, electric battery, as good as new, cost £3 in England, for plating battery and materials, or offers. F. Whitehead, Box 55, St. Augustine, Fla.

American and foreign coins to exchange; state what you have. W. J. Allen, 126 Twenty-third Street, Brooklyn, N. Y.

To exchange, fine imported game fowls of the best strain for Fleetwood scroll saw, compound microscope, telescope, magic lantern, shot gun, or offers. E. Alexander, Johnstown, Fulton Co., N. Y. Box 47.

J. T. Bell, Franklin, Pa., has set of ivory chessmen, German flute, six extra keys, value $12, books, etc., to exchange for magic lantern, music box, guns, revolvers, or offers.

Birds eggs and arrow-heads to exchange for fossils and minerals, and birds eggs; send for my list. Clement G. Burns, Salem, Col. Co., Ohio.

Minerals (zeolites, etc.), to exchange for other minerals; state what specimens you have to exchange. H. L. Clapp, 35 West Cottage St., Roxbury, Mass.

Type, in exchange for curiosities, fossils, etc. Geo. K. Fischer, 729 North 6th St., Philadelphia, Pa.

I have some stamps which I would like to trade for stuffed birds, birds eggs and nests; I am also open to an offer; send for list of stamps. A. G. G., Box 26, Summit, New Jersey.

U. S. and foreign postage and revenue stamps for others; U. S. match and medicine especially; send list or sheet and I will do the same. B. M. Hammond, cor. Elm and Live Oak Sts., Dallas, Texas.

To exchange for 1 new Vol. II, Young Scientist, 1 new Vol. I of ditto, and Prof. Bell's Lectures on the Telephone. F. H. Burger, Chester, Pa.

I have 2,000 foreign stamps that I would like to exchange for others. F. Cushing, P. O. Box 178, Wattsburg, Erie Co., Pa.

Wanted, a hand or self-inking printing press, small size, in exchange for books, magazines, papers, etc. B. D. Howell, High Bridge, Hunterdon, Co., N. J.

Demas lathe sea shells, rubber boots, California woods, YOUNG SCIENTIST and paper shells, for stencil dies, boxing gloves, revolver, foils, book on navigation, and manly arts. A. W. Port, San Diego, Cal.

To exchange, an $8 Challenge self-inking printing press, chase 3 x 5 inch, for type or offers. Address, by sealed envelope, Wm. F. Hill, 666 Bergen St., Brooklyn, N. Y.

To exchange, a $60 Wardwell (2 spool) sewing machine, nearly new, also a $3.50 stylographic pen, for coins and books, or offers. C. C. Bulkley, 195 Sigourney St., Hartford, Conn.

An Official Printing Press, must be in good order, and type to make a complete printing outfit; state what is wanted in exchange. W. E. Cushman, Hartford, Ct.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

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Common Telescopes.—II.

THE test of excellence in separating power has been fixed by Dawes at the quotient, expressed in seconds, of 4·56 divided by aperture in inches. Thus a 10-inch object-glass or speculum ought to separate double stars at 0″·456 of distance between their centres. This value practically concurs with those given by Dallmeyer and Alvan Clark. Reflectors somewhat surpass achromatics in this respect, as theoretically they ought to do; but they are apt to be more troubled by rings and flare, and scattered light. The best telescopes of either kind will bear a power of 100 per inch of aperture on stars: for planets, or the moon, half that power will usually more than suffice.

An object-glass of inferior definition may sometimes be improved by stopping out defects, or contracting the aperture. Streaks or specks of unequal density are very injurious; they may be detected by turning the telescope to a bright light, taking out the eye-piece, and placing the eye in the focus; every irregularity will then be visible in the illumination which overspreads the object-glass; and, if of small extent, may be stopped out by a bit of sticking-plaster. If the performance is not thus improved, try a contracted aperture: make a cap of pasteboard fitting over the object-glass like the usual brass cap, but with a circular opening a little less than the clear aperture—if the indistinctness is thus diminished, but not removed, try several discs of pasteboard placed successively within this cap with progressively contracted openings, till distinct vision is obtained; there we must stop, or valuable light will be lost. An eccentric opening in the pasteboard disc may sometimes be serviceable, being turned round the axis so as to expose different parts of the glass or mirror, till the best effect is produced; in other cases, a central pasteboard disc, supported by nar-

row arms from the sides, and leaving an open ring of light all round, may be tried. But for comets or nebulæ, it will be best to restore the original aperture, as with faint and ill-defined objects light is more essential than distinctness. The centering of a reflector is more liable to derangement than that of an achromatic; it is, however, easily rectified by the cautious use of the screws which are provided for the purpose. When in correct adjustment, the eye-piece being removed, a dark spot will be seen in the centre of the small mirror, which is the image of that mirror reflected by the large speculum; in proportion as it deviates from a central position, the adjustment is incomplete, and the performance defective.

The definition of reflectors may often be greatly improved by the use of a tube perforated with large and numerous openings; it is also desirable, where practicable, to interpose between the observer and the instrument, in cold weather, a moveable screen of felt or some non-conducting material.

A good stand is essential; if unsteady, it will spoil the most distinct performance; if awkward, it will annoy the observer; if limited in range, it may disappoint him at some interesting juncture. It may be well left to a respectable optician ; but where expense is a serious consideration, a little mechanical ingenuity and knowledge of such contrivances will devise one which will answer sufficiently. The old arrangement, with a vertical and horizontal, or "altitude and azimuth" motion, is simple and manageable; the equatorial form, which makes the telescope revolve on an axis parallel to that of the earth, has great advantages, in following the object by a single motion, and where the expense of divided circles and spirit-levels is admissible, in finding planets and bright stars by day, and identifying minute objects by night; but, to do its work, it must be placed accurately in the meridian, and out of that position has little superiority. The tube, too, must rotate in a cradle, or the ocular will assume very awkward inclinations. In any case, if the stand is to be movable, let it be strong enough for steadiness without being too heavy for portability.*

A sidereal clock is often considered a necessary adjunct to an equatorial mounting, in order to find objects invisible to the naked eye. But it may be dispensed with by the following method of "differentiation" in all cases, excepting during the brief season of twilight, when neither sun nor stars can be employed. Write down the difference of Right Ascension (taking particular notice whether additive or subtractive) between the required and some known object—the sun by day, a neighboring bright star by night. Seek the known object by the finder, and place it in the centre of your largest field; clamp the R. A. circle; set the telescope to the declination of the object sought, and clamp it there; unclamp in R. A. and move the telescope E. or W., as the case requires, to the value of the ascertained difference in R. A., and the object will be found in the field, somewhat W. of the centre, by a distance dependent on the duration of the process.

An observatory is by no means essential, but it would be difficult to overestimate its advantage in point of comfort as well as economy of time. It used to be an expensive luxury; but a very simple and cheap "telescope-house," combining shelter with open-air freedom, to the great merit of which I can bear full testimony, has been devised by the Rev. E. L. Berthon, and is described in the *English Mechanic*, Oct. 13 and 20, 1871. The Rev. W. Conybeare Bruce has also handled the subject very ably in the same publication, Feb. 6 and 27, and April 2, 1880.

We will close this section with the encouraging words of the Council of the Royal Astronomical Society, in their Report for 1828: "Every one who possesses an instrument, whose claims rise even not above a humble mediocrity, has it in his power to chalk out for himself a

* A very cheap equatorial stand is described in *Astron. Register*, xiv. 35. Franks observes that a common equatorial mounting may be made very efficient at a trifling expense by the addition of plain metal circles, on which slips of paper graduated with pen and ink are fastened by glue dissolved in strong acetic acid, and afterwards sized and varnished. A good pillar-stand may be made by letting a 4-inch iron pipe deep into the ground, in which a small table with a long foot revolves.

useful and honorable line of occupation for leisure hours, in which his labor shall be really valuable, if duly registered; . . . those who possess *good* instruments, have a field absolutely boundless for their exertions."—*From advance sheets of Webb's Celestial Objects for Common Telescopes.*

Etching on Copper.

SINCE the publication of the articles on Collodio-Etching, we have had several inquiries in regard to the method of etching on copper. The simplest and most thorough directions to amateurs for pursuing this interesting art are those by R. Scott Burn, which we here reproduce. The art of etching is not difficult to acquire, the principal requisite being the ability on the part of the operator to draw freely and accurately.

It will be our endeavor to describe the process in such a clear manner as to enable any one who has a knowledge of drawing to make a successful plate.

Etching enables us to produce lines on a metal plate capable of throwing off an impression. To effect this, it is necessary to cover the plate with a preparation which will resist acid. If on such a preparation acid is applied, it will not act on the copper; but if a scratch is made through the preparation, and the acid thereafter applied, it will eat into a line, deeper or shallower, according to the length of time the acid is allowed to remain. The metal generally used for etching is copper, the plates of which should be carefully prepared.

Etching is not meant, as some suppose, to be an easy method of imitating line-engraving; in fact, the grand distinction between the two styles is this, that in line-engraving the lines, however beautiful in effect, are produced by means more or less mechanical, while in etching, the lines and effect are put in with a facility of drawing and freedom of touch which is displayed in free pencil-sketching on paper. In etching, the needle and the aquafortis are the only assistants; the graver is seldom required, and the oftener it is used, the stiffer the drawing becomes, and more removed from that exquisite freedom and ease which is the characteristic of a true etching, representing, as it does, or ought to do, the ease with which the original design or subject is transferred to the paper or the canvass.

First, as to the "etching ground" This is a preparation of wax, asphaltum, etc., the following being a favorite recipe: Take of beeswax and asphalt two parts each; Burgundy pitch and black pitch 1 part each. Melt the wax and the pitch in an earthen vessel, and add the asphalt by degrees in fine powder. Expose to heat until a drop, which has been cooled, breaks by bending back and forth two or three times in the fingers. As much depends on the quality of the ground, the expense not being great, we would recommend our readers to purchase it ready made. It is sold by most of the dealers in engravers' tools, etc. In order to prevent any grit coming to the plate, it is better to inclose the ground in silk for the purpose of filtering any imperfection.

The following tools and implements are necessary: The "dabber," which is composed of silk of a fine texture, and evenly stuffed with wool until it assumes the form required (Fig. 1). It is necessary to place

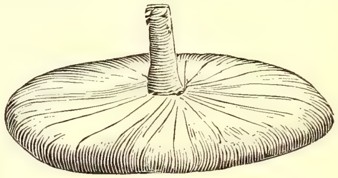

Fig. 1.

a circular piece of card at the top of the dabber, immediately below the handle. The "etching-point," the "graver," the "scraper," the "burnisher," and the "hand-vice." An etching table must also be provided, with the following accessories: A copper plate on which the subject is to be etched, with support and ruler. Looking-glass for the purpose of reversing drawing. Tissue paper strained on a thin frame to prevent the light from glistening too much on the plate. Black varnish for stopping out scratches and such tints as are "bit" sufficiently dark. Nitric acid. Water. Spirit of turpentine. An ordinary china or earthenware plate and pencils for mixing the varnish.

Fig 2. ETCHING POINT.

Fig. 3. GRAVER.

Fig, 4. SCRAPER.

Fig. 5. BURNISHER.

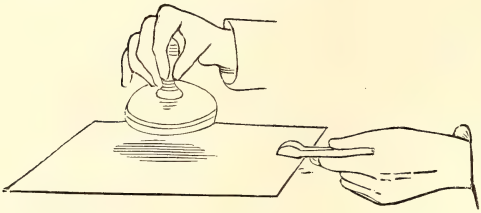

Fig. 6.

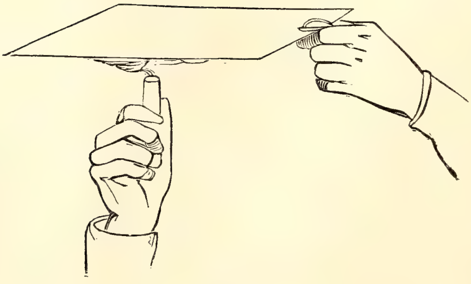

Fig. 7.

The first preparatory process is laying the etching-ground.

The plate having been polished from tarnish, in order to remove all grease from the surface, wash it well with spirit of turpentine, and, after the plate is dry, rub it carefully with whiting and wash-leather; then fix the hand-vice, and proceed to heat the plate either on the top of a stove, or by any other process by which a steady and not too great a heat may be obtained; in the absence of a stove, a piece of flat metal, heated and placed on bricks, is a good substitute. It may be known when the plate is sufficiently hot, by placing the etching-ground on the plate with a gentle pressure, and, after allowing it to remain a few seconds, pass it slowly from one end of the plate to the other; if a thin layer is equally left along the surface, the heat is proper. Continue to pass thin layers of etching-ground from end to end of the plate, at tolerably equal distances, and then, in the same manner, from side to side; the object of this is to place an equal quantity of etching-ground, in order that the dabber may spread it more readily over the surface; then take the dabber (Fig. 6), now in requisition, and use it by constantly dabbing over the plate for the purpose of entirely covering the portion of the plate required. When an even and complete layer has been obtained, take a wax-taper (Fig. 7), and next proceed immediately to smoke the ground; the taper must be kept in motion, in order that the whole of the ground may be evenly blacked; if the flame of the taper is allowed to remain too long in the same position, the ground will be burnt, and not offer sufficient resistance to the acid; and if the plate, during the process of smoking, is too cold, the smoke will not incorporate itself with the ground, but remain on the surface. The essentials of a good ground are, first, that the surface be *completely covered;* second, the covering to be as equal as possible, and not so thick as to prevent the free use of the etching point; and third, that it shall present, when cold, a polished black surface. If, when the plate is cold, the surface appears in parts dull, it is caused either by the ground being burnt by using too much heat while spreading the ground, or that, when smoking, the plate has been too cold. It is easy, when the plate is cold, to discover from which of these causes the dulness of the surface proceeds, by rubbing the part slightly with a soft handkerchief; if the black is removed to the handkerchief, the plate has been too cold when the taper was applied; but if the dull black remains on the plate, the imperfection has been caused by heat. If the dulness arises from the smoke lying on the surface, it may be readily altered by slightly heating the plate; if from burning, the ground must be removed by heat and spirit of turpentine, and the plate again thoroughly cleansed.

The best method of getting the subject transferred to the plate is to send a careful outline, either in pencil or red chalk, to a copperplate-printer, who will slightly damp and pass it through the press. If this is not convenient, a piece of tissue paper may be rubbed with powdered vermillion, and fixed with the colored side towards the plate. The tracing must then be put in its proper place, and fastened with wax at the corners to prevent it shifting. The outline must be then gone over with a blunt etching-point. This process will leave a clear outline in red, on a black ground. When thus transferring, the pressure should not be so strong as to damage the etching-ground.

The student will observe that, in order that the plate may throw off a correct impression, the subject must be reversed. This difficulty may be remedied by placing the drawing so that it may be seen in a looking-glass, which will have the effect of giving it the same appearance that it would have on the plate.

The plate is now prepared for the etching process.

A New Breed of Whales.—A whaling captain, lately returned from the Arctic seas, declares that a new breed of whales have made their appearance in those waters. They are supposed to have emigrated from the open sea at the Poles.

The Crawfish and the Minnow.

A FISH STORY IN RHYME.

BY L. M. HOSEA.

A pert little crawfish, crustaceous and fat,
Voting ancestral shingles and shallows a bore,
Determined one day, 'spite of warnings and all that
His elders could say, to remain there no more;
But to see the great world in the deeper blue water,
And the wonders of mid-channel far from the shore.

"You silly young brachi'pod"—spoke his old granny,
(Hard-shell old Baptist, with claws like a vice),
"Don't be a fool, like the genus humani,
"Those air-breathing bipeds who never grow wise,
"Except in exchange of expensive experience.
"Be happy at home, sir; there! that's my advice."

Then big Papa Crawfish: "Out there in the brine
"Are Ichthyosauri, and terrible Ptero-
"Dactylian reptiles, and catfish a-sighin'
"For juicy young headstrong crustaceans, who ne'er o-
"Vercame their propensity backward to wander,
"And hold their papa's admonitions at zero."

"Pooh!" quoth this impertinent juv'nal, "keep easy!
"Tell that to marines! D'ye see any green?"
And he put up one claw to his eye. "As for Ichthy-
"O'Soreeye, that's thin, much too thin to be seen.
"And as for that Terry Dac-what's-his name, why—
"Just let me alone; I'll run my machine."

Well, nothing would do this precocious knight-errant
But to wander abroad in the wide wat'ry world,
Over shingle and mud-bank, out into the current—
The pitiless current—that seized him and hurled
Him far out among swift darting fish, in the torrent
That rolled him and tossed him where angry waves curled.

Affrighted, dismayed, clutching wildly at naught,
Borne on by the flood in its fatal embrace,
He at length on a rock in mid-channel was caught,
And clung with despair to the shallowest place.
Cruel fish sported round in the swift-moving wat-
Er, where eddy chased eddy in mad whirling race.

Old Crusoe was never so much isolated,
On his little isle in the wide waste of sea,
As this little decapod—lonely, ill-fated,
Repentant young prisoner—bound by decree
Of the water-god fast to that rock, as I've stated,
With hungry fish waiting there under its lee.

He thought of his home—of the scenes of his childhood—
His playmates—his teeter-board, marbles, and ball—
His dinners of grub in the brook through the wildwood—
How hungry that made him!—and, lastly of all,
His own foolish boasts, which, to draw it but mild, would
Prove that pride ever precedes a great fall.

By-and-by came a minnow, borne on by the race,
And strayed in the eddy there formed in the tide,
Seeking refuge from divers (not sun-dry) great bass,
Whose fierce-gleaming armor-scales, mouths opened wide,
And pitiless optics, all threatened disas-
Ter to such little fish as in deep waters glide,

But, strange to relate, while such perils environ,
It pops in the head of our foolish young friend
To fall dead in love with that luscious young siren
(Siren? that's wrong; but no matter), and end
His misguided existence; and all for aspirin'
To things far beyond him, as I apprehend.

For, reaching out softly to clasp his fair prize in
His long taper claws, thinking only of love,
A bass darted up like a flash, or a rise in
Stocks, from dim depths to the surface above.
His jaws fiercely clapped on the minnow, entrapped
Thus by clap-trap—like many a poor human dove.

Now crawfish are curious creatures; behind them—
Like folks who leap blindly—ne'er viewing the goal,
They travel tail-foremost, and frequently find them-
Selves out of the plain road in some pesky hole;
Or, to finish this stanza as old Sancho Panza
Would—"Out of the frying pan into the coal."

So 'twas in this instance; the foolish macruran,
Scared out of his wits by the sudden attack,
To 'scape the fell jaws, darted back in a jiffy
Tail-foremost, of course, like a born maniac,
And fell plump in the jaws of another bass waiting,
Who gobbled young crusty in one single smack.

Moral:

So ends the sad tragedy; ring down the curtain.
The moral has troubled me more than you'd think.
For, if it be obvious, then it is certain-
Ly useless to waste on it paper and ink.
But if it be not so, why then it were better
Than writing this "pome," to have paused on the brink.

But the plain, simple truth is, in this case at least,
It's no dearth of morals that troubles me so.
I'm embarrassed with wealth—like the boy at the feast
When the pudding came on; and I really don't know
Which to choose; and therefore I mildly suggest
To you, Reader, to capture the one that suits you.

Cincinnati, March, 1881.

Three Amateur Workers—and What They Did—IX.

BY FRED. T. HODGSON.

"NOW," said Mr. Carpenter, on the following evening, "I will show you how to make the furniture for Jessie's play-house; but before we proceed to business it will be necessary that you be informed on a few matters touching the use of some

Fig. 30.

other tools I have procured for you, and a style of work you have not yet performed; namely, mortising and tenoning. A mortise is a hole of some given dimensions

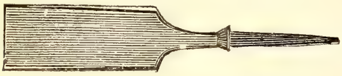

Fig. 31.

cut into a piece of wood or other material. Its object is to receive a tenon which is fitted tightly into it, and the two pieces thus framed together generally form a right angle. The mortise is made by first

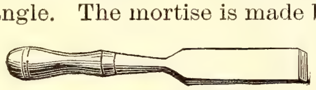

Fig. 32.

boring a hole at one end of it with a bit not larger than the width of the mortise. A chisel is used to remove the other portions of wood. The chisel is driven into the wood with a wooden mallet until it is more than half way through the stuff being mortised; the "core," or wood that

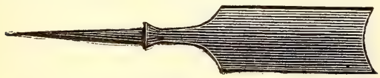

Fig. 33.

has been moved by the chisel, is then pried out of the mortise, and another cut is taken, and so on until the mortise is all cut on the one side. The piece is then turned over, and the same operations are gone through. You will notice that the mortise is "laid out" or marked on both sides of the stuff. On small stuff this is accomplished by using a mortise gauge, which you see is something like the single gauge you have been using, only it has a screwed spur, which can be adjusted to any width of mortise within the capacity of the tool, by a slide that is movable in a

Fig. 34.

slot. Sometimes this slide is controlled by a thumb-screw, which is attached to the end of the stem.

When the "core" or chips are all cleaned out of the mortise with a firmer chisel, and the ends properly squared down, it is then ready to receive the tenon.

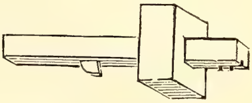

Fig. 35.

A tenon is formed with a saw, or rather with two saws—a rip saw being used to cut down the tenon lengthwise of the grain, and a back saw for cutting the shoulders. The gauge used for markin the mortises must be used for laying out the tenons without being changed."

Mr. Carpenter then explained how the lines were carried over the stuff to show the shoulders on the tenons and the ends of the mortises, with the try-square. It is often a puzzle to young people to discover how a line can be carried round the four sides of a piece of stuff and join without any divergence. If a piece of stuff is straight and parallel on every side, and a *true* try-square be applied with its stock against one edge, and the blade lapping over a side at right angles with the aforesaid edge, then a fine line drawn on the stuff along the edge of the blade; then

---

Fig. 30 shows a socket mortising chisel. Fig. 31 is an English duck-bill mortise chisel; the handle is made of wood and fits on the shank. This kind of chisel is seldom used now. Fig. 32 is a framing chisel, and Fig. 33 is a gouge. Fig. 34 shows a mallet. This is used to strike the handle of the chisel with when making a mortise; sometimes mallets are made with a square head and oval handle. Fig. 35 shows a mortise gauge of the cheaper sort. This can be made to do exact work if everything is tight about it.

the stuff turned, and the same operation repeated, with the blade of the try-square made to coincide with the work already made, there will be no difficulty in understanding the reason why any line may be

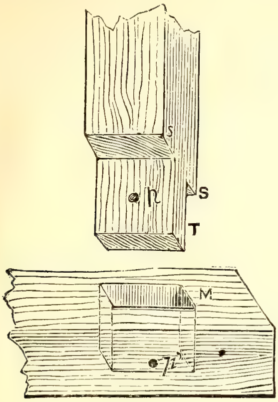

Fig. 36.

carried round a piece of *trued* stuff so that all the lines will meet at the corners, and yet be at right angles with the edges of the stuff.

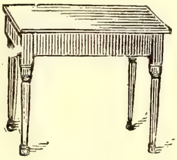

Fig. 37.

This matter being now fully understood, Mr. Carpenter instructed the boys how to make a table like the one shown in Fig. 37. The legs and sides were cut out with

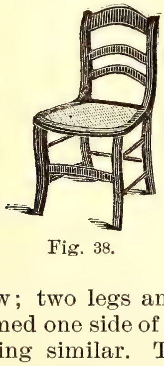

Fig. 38.

the scroll saw; two legs and one side in one piece formed one side of the table, the other side being similar. The ends were cut out seperately, and were glued and bradded on to the legs, as shown. The following are the dimensions of the pieces used in making the table:

Height of legs and sides, 2¾ inches.

Length of sides over all, including legs, 5½ inches.

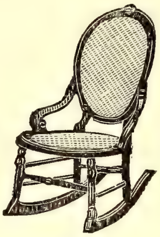

Fig. 39.

Length of the end pieces over legs, 2½ inches.

Length of table top, 6 inches.

Width of table top, 3 inches.

Width of end and side pieces, half-inch.

The stuff used for the table should not

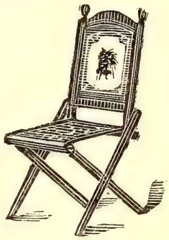

Fig. 40.

be less than half an inch thick, and may be of white-wood, pine, or other soft wood, and, when finished, should be painted in appropriate colors.

Fig. 36 shows a tenon and mortise. The tenon, T, should seldom exceed one-third of the thickness of the stuff, otherwise the piece containing mortise, M, will be weaker at that part than the tenon. After the tenon has been driven home, so that the shoulders, S S, bed fairly on the surface of the wood around the mortise—in which they will fail if all the parts be not exactly square—the hole, *p p*, must be bored, but rather smaller than it will ultimately be required. The tenon must then be withdrawn from the mortise, and the hole, *p*, be enlarged to the proper size for the pin; *p* must also be increased to the same size, but its centre is removed a trifle towards the shoulders, S S, so that when the tenon is reinserted in the mortise, the holes, *p p*, will not exactly tally. The discrepancy should be very slight, otherwise the tenon may be split when the pin is driven home. By setting the hole in the tenon a little behind that in the mortise, the pin is enabled to draw the tenon forward until both the holes correspond, when the shoulders, S S, will bear firmly on the surface, M.

It will be noticed that the table is made on the same scale as that used in building the house, and the other pieces of furniture that follow will be built on that scale also.

A good height for a dining table is about 2 feet, 8½ inches. The one described will, when finished, represent a height of 2 feet nine inches, or, by actual measurement, two inches and nine-twelfths, which, according to our scale of one inch to the foot would represent a table two feet nine inches high, by six feet long and three feet wide.

In making the chairs, each side of Fig. 38 should be cut out of one piece, and the cross pieces on the front, back and seat should be tenoned, and fit into mortises in the side pieces and legs. Small chairs like this may be sawed out of the solid, but this requires a larger saw than the one Fred and Ellwood now possess.

The rocking-chair, Fig. 39, should have the back and two legs cut out of one piece, the seat out of another, and one front leg, rail, and one rocker out of another. The scrolls forming the arms and the one front rail, are cut from separate pieces. The back legs are tenoned into the rockers, and the front legs are tenoned into the seat; the front rail is also tenoned into the front legs. The scrolls or arms are glued on and bradded; the back legs are also bradded and glued to the seat.

The camp chair, Fig. 40, requires no explanation; the construction is so simple that the boys found no difficulty whatever in making one. A few straight strips of walnut half an inch wide, and less than a quarter of an inch thick, were used for the frame, and a narrow strip of flowered silk was used for the seat and back; this was glued to the strips where necessary.

Eighteen inches is the height to make a chair seat, from the floor, and the height of a back should be about two feet ten inches. This would make our chairs one and a half inches high to the top of seats, and two inches and five-eighths to the top of backs. These sizes make the chairs in the same proportion as the house.

An Old Cement Revived.

MANY years ago it used to be a practice amongst housewives to mend broken china and crockery ware very thoroughly and in a very simple manner. The plan has fallen into disuse, and although it is *mentioned* in one or two books, we know of no case in which it is *described*, and it is years since we met any person who is familiar with it.

The plan is simply to bind the broken surfaces firmly together, and boil the article in skim-milk. We have seen cups, plates, bowls, and other articles which seemed to be beyond all possibility of being repaired, mended in this way, so as to be almost as good as new, the joints being very strong and almost invisible.

The secret of success seems to lie in binding the parts firmly together, and boiling for a sufficient length of time. The tying together of the pieces of a round cup or bowl is not a very simple matter, but it can be done by going the right way to work. First, arrange the parts in their proper positions, and, if a bowl, set it mouth down, as the pieces will keep their arrangement best in this position. Then wind stout tape round the article, so as to hold the pieces together. Tape is far better than twine, and some pieces should be kept for this purpose. It is easy to draw the tape tight until we come to tie the ends, and then special devices must be used. When sufficient tape has been wound round the article, let one person hold it from slipping, by pressing a finger firmly on each end, and then let another person tie the ends in a firm knot, but leaving the tape so loose from the article that a pencil or stout skewer may be passed under it. Then by twisting the skewer the tape is tightened in the same way that a surgeon compresses an artery with his tourniquet, and by passing the fingers over the tape, and smoothing it forward toward the ends, all the pieces may be pressed together with a firmness that cannot be obtained in any other way.

The article should now be placed in a pan of cold milk (skim-milk is the best and cheapest), which should be gradually

heated to the boiling point, and kept at this temperature for some time—say half an hour to an hour—care being taken not to allow it to burn. The articles are allowed to cool in the milk, and when taken out are wiped dry and allowed to stand for a day or two until the cement has become quite hard. They may then be washed off with warm water, and the parts will be found to be strongly cemented together. The same milk may be used again, but not with such good effect. Generally, however, it is possible to pack quite a number of articles in the pan in the first place, especially if they can be *nested*, or placed one within the other.

Lens Making.

A WRITER in the *English Mechanic* thus describes his method of grinding and polishing lenses:

So far as microscopic glasses are concerned, the modes usually proposed are very tedious, troublesome, and most uncertain. I have devoted many years to making for my own use achromatic and other lenses for microscopic object-glasses; and as it may be useful to some who grind their own, I send a general description of the way I go to work, first stating that I take from ten to twenty minutes to make a plano-convex from the rough, if no accident happens.

I take a piece of glass and cement it to a chuck, and then turn it with a hard steel tool to the required radius. There is no trouble in doing this if the tool is wetted with saliva. I find this far superior to anything else. I then grind it smooth with a brass tool, and, after washing, go on grinding it with the same emery, only covering the tool with a bit of silk. I use oil just at first, and then water. This will go some way towards polishing. I then clear away the emery, and work the glass on the silk with putty powder, now making the lens revolve for a little time till all scratches are nearly removed, and then finish it with the tool revolving. The reason for making the lens revolve is that the putty powder acts very much quicker, and so saves time and trouble. The emery I use is the common flour-emery washed once. I use the finest part, and this is quite enough, as I turn the lens to the right shape, so that it requires very little coarse grinding. While the lathe gives a circular motion, the hand should move backward and forward, changing the position of the lens. This gives a true figure. I use different silks for slight alterations in the focus.

Something Nice.

WE have just secured a few miniature "charm" opera-glasses, which we feel sure will please those of our readers that get one. These little opera-glasses are of white ivory, being single tubes about half an inch long, and having an opening through them of about a sixteenth of an inch in diameter. On looking through this hole in the same way that we would look through a common spy-glass, there will be seen a portrait, view, or enlarged picture, of the Creed, Lord's Prayer, etc. These pictures are so small as to be quite invisible to the naked eye, but there is a powerful magnifier in the little ivory tube, and when we look at the pictures through it they appear to be quite large and very distinct.

We will send one of these postpaid to any of our subscribers that will procure for us another subscription, and send on the fifty cents. For all sums under one dollar we accept postage stamps at their full value.

Correspondence.

A Wise Woodpecker.

Ed. Young Scientist—Last summer, while walking in the woods, I found the nest of a golden-winged woodpecker (*Colaptes Auratus*) built in the hollow of a dead tree. Wishing the eggs for my collection, I got a boy to climb the tree and collect the eggs for me, which he did with little trouble. A few days later, while walking by the same tree, I heard the woodpecker hard at work deepening the hole which had previously contained the eggs, with a view, I suppose, of protecting its eggs in future from all mankind, which I have no doubt it succeeded perfectly in doing.

ALEXANDER G. GIBBS.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business letters or cards they cannot be used.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange,* the preference being always given to those who have not previously used our columns.

To exchange, for engine or offers, a pair of Bliss Telephones and 200 feet of copper wire. J. W. Grant, 402 Broad St., Newark, N. J.

To exchange, a 2½ octave chromatic xylophone for microscope, microscopical apparatus, scientific books, or offers. J. E. Moore, Box 81, Newcastle, Ind.

Photographic camera, with lens for taking 3¼ by 4¼ pictures, tripod, plate holder, printing frame, instruction book, etc., in exchange for electrical instruments or offers. W. Chamberlain, 446 Broome St., N. Y.

I have McAllister's Naturalists' Microscope, with achromatic triplet objectives, used only 2 months, cost $12.00. I wish to exchange for an inch or 2-3 inch objective. Address, with particulars, F. F. Colwell, Urbana, Champaign Co., O.

To exchange for offers; a small lot of microscopic mounting apparatus. List on application to J. N. B., Box 1468, N. Y.

To exchange, books and YOUNG SCIENTIST, and trinkets, for other books, revolver, or stylographic pen. Frank Bicknell, Humboldt, Iowa.

Ancient petrified grain, Indian pottery, birds eggs, papers, magazines, Confederate money, fossils, minerals, to exchange for arrow-heads, Indian relics, Confederate, Continental, and other paper money. Fred T. Brinkerhoff, Box 347, Neenah, Wis.

Minerals, tricks, copper coins, book on pigeons and rabbits, Wilson School History, for book on experiments, or specimens, minerals, stamps or coins. P. R. Bradley, Box 305, Dunkirk, N. Y.

Wanted, a second-hand screw cutting foot lathe, must be in good condition; state what is wanted in exchange, also size and make of lathe. G. A. Clark, Castalia, Iowa.

To exchange, minerals, shells, fossil shells, birds eggs, etc., for minerals, shells, fossils, stuffed birds, birds eggs, and books. U. S. Grant, Des Moines, Iowa.

Wanted, botanical correspondents for the coming season, also amateur correspondents in chemistry. L, Box 70, East Templeton, Wov. Co., Mass.

Wanted, to exchange a well-equipped job printing outfit, for books or offers. Frank A. Niblack, Rockport, Ind.

Will exchange for Vol. 2 of the YOUNG SCIENTIST, instructive books bound in cloth to the value of $1.50. Chas. H. Williamson, 293 Eckford St., Greenpoint, Brooklyn, N. Y.

I have a new Munsen's battery, large size, which I wish to exchange for a good revolver or offers. Robt. T. Boyle, 351 West 83d St., New York.

Hair of American deer to exchange for diatoms, foraminifera, or other material. W. H. Osborn, Chardon, Ohio.

To exchange, full instruction in short-hand writing, and birds eggs, for birds eggs, postage stamps, or offers. M. F. E., 51 Spencer St., Albany, N. Y.

"History of Our Country," by Lossing, in six parts, price $15, to exchange for printing press or offers. Frank Chandler, Waverley, Mass.

Fine Devonian and Carb. fossils for others, especially cretaceous fossils, scientific books or papers; Pitman's short-hand works for books or offers. A. Stapleton, East Point, Tioga Co., Penn.

Wanted, scientific books and apparatus; send lists and say what is wanted in exchange. Ewing McLean, Greencastle, Ind.

Wanted, specimens in geology, entomology, oology, etc., for those in other localities, also coins and a charm microscope (magnifies 1,000 times) for one having a different view. J. H. Jones, Frankfort, N. Y.

Send for exchange list of insects, especially Coleoptera and Lepidoptera. Philip Laurent, 621 Marshall St., Philadelphia, Pa.

For printing press or offers, achromatic telescope, $8.50; microscope, $5; set drawing instruments, $3; revolver, $3; Phrenological Journal, $2.50; books, 12 plays, farces, dramas, burlesques, etc., $1.80. F. E. Payne, Alma, Mich.

One pair 3 lb Indian clubs, one scroll saw, one pocket lantern, and a large number of books, for magic lantern, pair telephones, photographic camera, or offers. Thos. A. Black, Lock Box 678, Scranton, Pa.

For exchange, pocket lantern and instruction books for cornet and clarionet; wanted History of the "Franco-Prussian War," and the "Lost Cause." C. W. Hughes, Shreve, Wayne Co., Ohio.

I have Brown's heavy scroll saw attachment, worth $6, which I wish to exchange for a lathe chuck or offers. C. B. Russell, Waterbury Centre, Vt.

Will exchange magnets, electric battery, as good as new, cost £3 in England, for plating battery and materials, or offers. F. Whitehead, Box 55, St. Augustine, Fla.

American and foreign coins to exchange; state what you have. W. J. Allen, 126 Twenty-third Street, Brooklyn, N. Y.

To exchange, fine imported game fowls of the best strain for Fleetwood scroll saw, compound microscope, telescope, magic lantern, shot gun, or offers. E. Alexander, Johnstown, Fulton Co., N. Y. Box 47.

J. T. Bell, Franklin, Pa., has set of ivory chessmen, German flute, six extra keys, value $12, books, etc., to exchange for magic lantern, music box, guns, revolvers, or offers.

Birds eggs and arrow-heads to exchange for fossils and minerals, and birds eggs; send for my list. Clement G. Burns, Salem, Col. Co., Ohio.

Minerals (zeolites, etc.), to exchange for other minerals; state what specimens you have to exchange. H. L. Clapp, 35 West Cottage St., Roxbury, Mass.

Type, in exchange for curiosities, fossils, etc. Geo. K. Fischer, 729 North 6th St., Philadelphia, Pa.

I have some stamps which I would like to trade for stuffed birds, birds eggs and nests; I am also open to an offer; send for list of stamps. A. G. G., Box 26, Summit, New Jersey.

U. S. and foreign postage and revenue stamps for others; U. S. match and medicine especially; send list or sheet and I will do the same. B. M. Hammond, cor. Elm and Live Oak Sts., Dallas, Texas.

To exchange for 1 new Vol. II, Young Scientist, 1 new Vol. I of ditto, and Prof. Bell's Lectures on the Telephone. F. H. Burger, Chester, Pa.

I have 2,000 foreign stamps that I would like to exchange for others. F. Cushing, P. O. Box 178, Wattsburg, Erie Co., Pa.

Wanted, a hand or self-inking printing press, small size, in exchange for books, magazines, papers, etc. B. D. Howell, High Bridge, Hunterdon, Co., N. J.

THE Young · Scientist

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Three Amateur Workers—and What They Did—X.

BY FRED. T. HODGSON.

THE following evening Jessie was anxious to begin work as soon as she returned from school. After the carpet was nicely bound with drab dress braid, Jessie proposed making some little rugs and mats of the smaller pieces. Mrs. Carpenter thought that it was a good idea, and proceeded to draw a large oak leaf on a piece of drawing paper that Fred had left on the table. "Why, Mamma, what are you going to do?" said Jessie, whose curiosity was aroused by so unusual a proceeding. "Well, Jessie, if you just watch me you will see."

After Mrs. Carpenter had traced the outline of the leaf on the paper, she cut it out and laid it on a piece of wine-colored plush.

"Oh, Mamma, I see what you are going to do now!" said Jessie, looking delighted as her mamma cut out the leaf and laid it on a stiff piece of canvas. "Now, Jessie, do you think you can button-hole stitch this evenly around the edges?" "Yes," answered Jessie; you know you showed me how to do the bottom of dolly's dress, and I have not forgotten how." "Well, then, Jessie, get some drab floss, or perhaps fine worsted would be the best for this one, and if you succeed in doing this nicely you may use floss for the next."

Jessie got the worsted, and her mamma did the first few stitches for her. Jessie's little fingers worked busily for about an hour, and half of the leaf was finished.

Some of the stitches were a little uneven, but, considering that Jessie was only nine years old, it was done very well.

"Mamma," said Jessie, "don't you think it would look nice with something in the centre, a little flower or vine?" "Yes, Jessie, it would be very nice, but I intended tracing the little veins, that are usually in oak leaves, and working them

with worsted. This is only an experiment, and, if we like the design, we may make some other, perhaps more elaborate, for the other rooms."

By this time Jessie had the little leaf stitched all round, and Mrs. Carpenter finished it. It was quite a pretty and odd device.

"Now, Jessie, here is a piece of plush, it is just the right size for a rug to put in front of the sofa, if we have one, or perhaps beside the bed; it is just twice as long as it is wide, and I think we will leave it as it is, and you can stitch it around as you did the other; and when that is finished, we will lay the carpet and rugs away until we are as far advanced with the other rooms as we are with this one, and probably by that time Fred and Ellwood will have the furniture ready to upholster." "Yes, mamma, I think that will be the best plan."

Mrs. Carpenter and Jessie were hard at work, when Ellwood came running in at half past nine to tell his mamma and Jessie that they were going to work a little later than usual, because Fred was anxious to finish one of the little cornices that night, so he could bring it in to show Jessie. Jessie was now getting sleepy, but insisted upon staying up until Fred came in. He soon made his appearance with his papa, and under his arm the cornice.

"What do you think of it, Jessie?" said Fred. "Think of it? why, I think it is just lovely!" answered Jessie, looking at it with delight, "don't you, Mamma?" Mrs. Carpenter thought it was very nice, of course.

"I fear you will make our boy vain, you praise him so much," said the father of this little flock, as Fred and Jessie were preparing to bring their evening's work to an end by putting their things away.

"Oh! no," said Fred, laughing, "little things like that don't affect me in the least;" but, nevertheless, Fred was pleased and proud of his work.

Jessie wanted to make the carpet for the parlor the next time her mamma and she sat down to sew for dolly's house, and Mrs. Carpenter consented. They had had a good many talks about furnishing this important room, and had decided to furnish it in blue, because, as Jessie said, "it would be so becoming to dolly's pinky complexion and golden hair." This carpet was to be made of canvas, the same as is ordinarily used for woolwork, perhaps a little coarser. Mrs. Carpenter had the canvas in the house, and cut it out, so that Jessie could begin to work it.

"The parlor floor measures 18 x 14 inches, doesn't it Jessie?" said Mrs. Carpenter, "so I have cut it one inch longer each way, and now you can hem it around the edges to prevent it from raveling."

As dolly's parlor was not to be used by any but herself, they selected the pretty shade of *ciel-blue* for the ground of the carpet, and the pattern was to be worked in some contrasting color.

The carpet was now commenced, and Jessie worked very dilligently at it in her leisure time. Mrs. Carpenter traced a little vine of moss rosebuds and leaves near the edge of the canvas, for a border, and they decided not to have anything in the centre, as the room was so small. Mrs. Carpenter worked the buds for Jessie with pale-shades of pink worsted, and Jessie did the leaves with drab, and then filled them in with blue.

Some time elapsed before Jessie commenced her carpet, but, being fond of work of that kind, it did not take her long to do it, considering that she went to school, and had some lessons to learn when she came home in the afternoon. The carpet was finished, however, and Jessie thinks there is nothing like it in this or any other country.

The boys having completed the house, and being anxious to make something for their mother, of whom they were very fond, decided to ask her if they could not make her something now; so the following morning, at breakfast table, they asked her if there was not something she wanted they could make for her.

"Well, children," said Mrs. Carpenter, "I would like either a nice toilet stand for Fred's room, or a small umbrella stand for the hall leading from the side entrance of the house, if you think you

are able to make either one or both of these articles."

This pleased the boys, and they immediately persuaded their father to assist

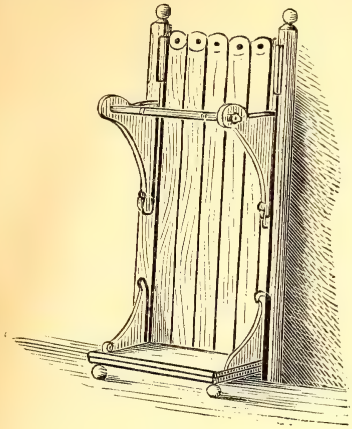

Fig. 41.

them to make the articles, and to purchase materials for them.

The engraving, Fig. 41, shows a design of an umbrella stand the boys decided to make. In our next paper we will see how they prepared their stuff and put the work together.

Etching on Copper.—II.

When etching, care must be taken to prevent any grease from coming into contact with the etching-ground; and it is proper to fix pieces of thin wood or folded paper round the edge of the plate, in order, with the help of a ruler, to form a sort of bridge on which to rest the hand. This precaution is necessary in order to protect the ground from scratches. These supports may be fastened with bordering wax. The etching-point is used in a similar manner to a blacklead-pencil; and it is very important to bring it into good working condition by rubbing it on a hone or leather strop. The point ought to be of such a degree of sharpness as to move freely on the plate; at the same time it is necessary that each line should go completely through the ground, otherwise the etching, after biting, will present a very rotten appearance.

Wax is now used for the purpose of forming a wall round the plate of about an inch high to confine the acid; it is composed of beeswax and Burgundy pitch, in the proportion of one pound of beeswax and a quarter of a pound of Burgundy pitch. The ingredients must be chopped into small pieces, and allowed to boil slowly in an earthen pipkin. As soon as the whole is dissolved, it is necessary to pour it into a basin partly full of warm water; it must then be worked by the hands until it becomes a pliable substance similar to shoemaker's wax. When using the bordering wax, it may be placed in hot water for the purpose of rendering it more workable, and it is necessary to be very careful to press it closely to the plate in order to prevent the acid from escaping (Fig. 8). It is also better to varnish round

Fig. 8.

the inside of the wax with great care, lest the ground underneath the wax may have been removed. If not thus protected, the margin will be filled with holes, which are troublesome to remove.

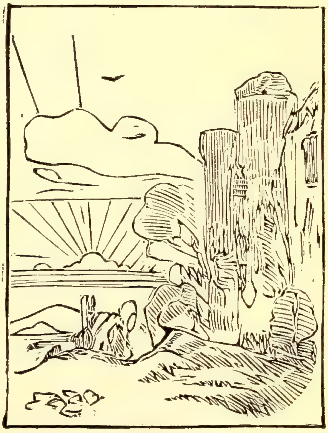

Fig. 9.

It is difficult to give any precise directions for biting, as much depends on the

strength of the acid, the hardness of the copper, and the degree of pressure which has been laid on the point when etching.

The following figures illustrate the appearance of the plate at different stages of the biting-in process. Fig. 9 represents the etching as it would appear after the acid had been applied five minutes; Fig. 10, the etching with the lightest tints

Fig. 10.

stopped up with varnish. Fig. 11 represents the etching as it would appear after

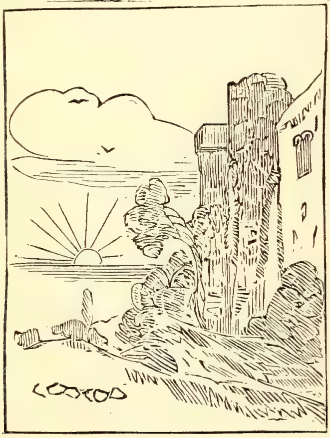

Fig. 11.

the acid has been applied ten minutes; and Fig. 12 after it has been applied fifteen minutes.

Generally the nitrous acid sold bydruggists may be diluted with a little more than twice the quantity of water; but until the student has by experience acquired a knowledge of the action of the acid, it will be advisable to make frequent

Fig. 12.

examinations of the etching, lest the tints are bit too dark. In order to effect this, the acid must be poured off, and then the plate carefully washed with water, and dried either by blowing with a pair of bellows or by dabbing with a very soft handkerchief; a portion of the etching-ground can then be removed by the scraper (see page 72). If the line is not dark enough the plate can be stopped up with varnish, and when dry the acid can be again applied. It is, perhaps, well to mention that the common *Brunswick black*, used for blacking chimney ornaments, is a very good varnish for stopping-out. This varnish may be had at any oil shop. A plate, if covered with this varnish, and permitted to dry, will as effectually resist the action of acid as if covered by the etching-ground; but it is not so proper for the purpose of etching, as it cannot be so neatly removed by the point. Care must be taken in all cases not to put the acid on the plate until the varnish is dry. If this is not attended to, the varnish, instead of protecting the plate, will rise to the surface of the acid, and the plate will bite into holes in such portions as the varnish has been removed from. It may be easily known when the varnish is sufficiently dry, by breathing on it; if the

breath remains for some time on the surface, the acid may be applied with safety; but if it rapidly passes off, then it is not safe. It is a consideration in biting to produce a clear deep line. This desirable quality is more likely to be produced by pouring a depth of at least half an inch of acid on the plate, and by carefully removing, with a very soft feather, the small globules which will be seen to congregate on the surface of the plate. The biting is the most uncertain portion of the process of etching, and the most experienced are liable to fail. For general purposes, however, a very little practice will ensure success. When it is considered that the etching has been bit to a sufficient color, it is necessary to remove the bordering wax by heating the plate, and then clearing it with spirit of turpentine, and afterwards rubbing with oil and a soft rag; it will then be necessary to send to the copperplate printer for a proof.

The process of copperplate-printing is exactly the reverse of printing from woodcuts and type. In the latter the ink is passed from the surface of the block, etc., to the paper by means of pressure; in the former the impression is delivered from an incised line. In copperplate-printing the whole of the surface of the plate, and also the lines, are covered and filled with ink; the printer then (with the assistance of heat and whiting), by passing his hands gently and repeatedly over the surface of the plate, removes the ink from the entire surface, but leaves it in the lines or scratches. Damp paper is then passed through the rollers of the press, between the upper roller and the plate are several layers of cloth, and the ink from the lines is thus placed on the paper. If it is found, on examining the proof, that some portions of the etching are not sufficiently dark, the fault may be remedied by "rebiting."

The lines on the plate *must be most carefully* cleaned from all remains of printing ink, or any substance that would interfere with the proper application of the etching-ground or acid. It is best to wash the plate well with spirit of turpentine and a perfectly clean rag; then rub the lines and surface of the plate with spirit of turpentine and bread, and afterwards with spirit of turpentine and whiting; after that with whiting and bread. If any portions of whiting remain in the lines, it can be removed by wash-leather and soft bread: the object of all this care is to free the lines from any impediment to the action of the acid, and to enable the student to cover the *surface of the plate* with etching-ground, so that, the surface being protected from the action of the acid, but the *lines left unfilled*, the parts which are already sufficiently dark can be stopped up with varnish, and acid applied in the regular manner, and an increase of depth be got on any part of the plate that may be required. The principal things to be attended to in laying a rebiting ground are, that the lines shall be left free from etching-ground, and the surface completely covered; if this is not attended to, the acid will fill the parts of the plate that are not covered with varnish or ground with numerous small holes, which will certainly produce impure tints; this appearance is known among engravers by the name of foul biting. The dabber used to lay the etching-ground may be used for the rebiting-ground; but it is perhaps well not to apply so much heat, as the ground, if too thin, is liable to run into parts of the lines; this produces, perhaps, as ill an effect as foul biting, for if the acid is placed on such a ground, it will cause an unsteady or rotten appearance, by biting the lines which are clear to a greater thickness than others.

Considerable finish may also be got by using the "dry-point," which is nothing more than an etching-point made sharper than it is required for the purpose of etching; indeed, it is used for scratching such lines into the copper as will throw off an impression. On examining a line made with the dry-point, it will be found that the metal is not removed as if cut with a sharp graver, but merely pushed to one side; if this, which is called the burr, is allowed to remain, it will, by its roughness, collect the ink and form a blot on the impression. To remove this burr it is necessary to use the scraper in such a manner as not to drive the burr back

into the line, but rather to cut it from the sides in order that each line may be thoroughly clean.

The graver is used to increase the darkness of small portions, and is used in the hand as follows:

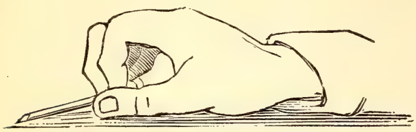

Fig. 13.

How to Make Emery Wheels.

BY W. B. HARRISON.

EMERY wheels should be made from clear, soft pine stuff that is well seasoned. By clear stuff is meant boards that are free from knots, cracks, or cross grain. These boards should be planed smooth on both sides, and then sawed into circular pieces a little larger than the finished wheel is to be. It is best to glue two or more of these circular pieces together, and glue them so that the grain of each piece will be at right angles to the one to which it is attached. If the stuff be inch thick when unplaned, it will be about seven-eighths of an inch thick when planed, and two of these pieces glued together will make a wheel of ample thickness for the use of the amateur mechanic.

If it be desired to make the wheel very strong, bore six or eight half-inch holes through the wheel, equi-distant from each other, within an inch or so of the periphery. Make pins of soft pine to fit these holes, coat them with glue, and drive them in snug, sawing off the projecting ends. The glued work must be thoroughly dry before advancing further. The next step is to form the discs into wheels, and the first proceeding is to make the hole to fit the spindle on which it is to revolve. To bore these holes with a bit or auger would, in all probability, result in a hole that would not be at a right angle with the side of the wheel. The proper way is to fasten the discs to the face-plate of a lathe, with screws inserted in holes from the back side the plate. When so fastened that it will revolve true, a gouge or narrow chisel can be used to cut the hole, and it can be made very nice and true. Take care to make it to fit the spindle on which it is to run. If an iron or metal bushing is to be inserted in the hole, turn out enough so that it will fit nicely in place before the wheel is removed from the face-plate.

The next step is to put it on the spindle on which it is to run, using a gouge to rough it into a circular form, and a chisel to make the surface smooth. The sides can now be turned up true. The periphery of the wheel must be covered with thick leather, and for this purpose the same kind of leather that belting is made of is generally used. Many mechanics get leather belting for this purpose. When all is ready, and a kettle of good glue prepared, lay one end of the leather on the circumference of the wheel and fasten it there with two or three shoe pegs. Insert the pegs in both leather and wheel by driving them into holes made for the purpose with a bradawl. Remove the leather with the pegs in it, spread the glue from the holes made for the pegs for a little distance in the direction in which the leather is to be put on, put the leather in place, inserting the pegs in the holes, and drive them home with a hammer. When glueing the leather, it is best to hold the wheel firmly in a vice, or stand, in such a manner that the leather can be pulled tight on the wheel as it is being glued. After pegging the edges of the leather as far as glued, at intervals of an inch or so, put on more glue, and so proceed until the end is reached, where it was first fastened; cut off the leather so that it will just meet this end; form a close joint; glue it well and securely peg it in place. Lay the wheel aside until the glue is thoroughly dry. The wheel may then be put on the spindle in the same way it was when turned, and the leather turned off true and smooth with a sharp gouge, finishing it with a sharp chisel.

Glue of only the best quality ought to be used in making emery wheels, and especially to fasten the emery to the leather surface. Prepare the glue as for glueing wood, and use it pretty hot, taking care that it is not too thick. The emery

to be applied is spread upon a level surface; a rod or stick is put through the hole in the wheel as a means of turning it; glue is then applied smoothly and evenly to the leather surface. Take an end of the stick or rod in each hand, with the wheel between them, and roll it in the emery until an even coating is retained on the glue-covered surface. Lay it aside to dry, being careful that nothing scratches or mars the freshly-coated surface. If the emery be applied warm by spreading it upon a warm board, or an iron plate also warmed, there will be no danger of the glue being chilled while the emery is applied, and a more lasting surface will be the result.

The grades of emery may range from No. 60 to 90, according to the work to be done. The coarser is used for cutting down a surface, and the finer for finishing and polishing.

In putting on the leather, some persons prefer to put the hair side of the leather to the wheel, giving as a reason that the flesh side is softer, and makes a more elastic wheel. In doing this the hair side must be thoroughly scraped before being glued to the wood. If it be desired to make a wheel elastic, two thicknesses of leather may be used, putting on one and letting it dry, turn it off, and put on a second one over the first; turn it off and coat with emery.

Wheels of hollow or round form can be easily made. Turn the wood to the required slope, and then go to a harness maker and have the leather rolled to the desired form by running it between the rolls that are used to shape leather in a hollow or round form for harness making. Apply the leather, and fasten to the wheel in the same manner as in making a flat wheel.

It is necessary to have emery wheels balanced. That is, one side must not be any heavier than the other. To ascertain where this balancing is required, put the wheel on the spindle on which it is to run, or on a tight-fitting wood rod inserted in the spindle hole. Have two straight edges of iron prepared, and fastened perfectly true and horizontal—wooden straight edges may be used, with the edges made pretty sharp, and these sharpened edges set uppermost. They must be placed parallel to one another, and at a distance apart to receive the wheel between them. On placing the wheel with its spindle on these straight edges, if one side be heavier than the other it will slowly revolve until this heavy side is at the bottom. Mark the side that is uppermost, bore a hole there, and drive in a rifle or pistol bullet. Try it again, and so continue until it will lie at rest on the straight edges. Where access can be had to an iron lathe bed, with the opening in the shear wide enough to receive the wheel, it is a very good substitute for the straight edges.

Wheels can also be covered with canvas or common sail cloth in place of leather. If several thicknesses are put on it will give an elastic wheel. Probably the most elastic wheel that can be made is by covering the wheel with stout cotton cloth, putting it on loosely, and stuffing cotton between the cloth and the wheel. Take care to put in the cotton evenly and alike all around. The cloth can be fastened to the wheel by using smooth-headed tacks, driven through it into the wheel at the sides near the periphery.

When the coating of emery wheels becomes worn by using, and is "dull" as it is termed, another coating may be put on over the first. A third may be put on over the second one. But when it gets uneven, it is best to soak off the old coatings with warm water. This may be done by putting a wet cloth around the glued surface, changing it occasionally until the glue can be scraped off. The scraping can be done with a knife that is not sharp enough to cut the leather. When dry apply a new coating. In places where many wheels are used, when the old coatings require to be removed they are revolved with the coated surface just touching the water. They can also be placed over a pan of water, and turned occasionally by hand until the surface is sufficiently softened to admit of its being scraped off.

—When the inscription on a coin is illegible, heat it gradually as hot as it will bear, and the letters will come out quite plainly.

Common Telescopes.—III.*

THE MODE OF OBSERVATION.

An ordinary telescope may be easily prepared for use: to fix it on its stand; to point it by means of the finder; to adjust the focus to the eye (remembering that different eyes require different adjustments), are processes scarcely requiring instruction. But many mistakes may be made in detail; and in this, as in everything else, there are various methods of doing the thing the wrong way. The present section will therefore consist of negative rather than positive directions, pointing out rather what should be avoided than what should be done.

1. Do not begin by fixing the telescope in a warm room and opening the window. A boarded floor is bad, as every movement of the observer is liable to produce a tremor; but the mixture of warm and cool currents at the window is worse; it is an artificial production of the fluttering and wavering which, as naturally existing in the atmosphere, are such an annoyance to astronomers. If a window must be used, let it be opened as long beforehand as may be, and let the object-glass be pushed as far as possible outside; there should be no fire in the room; and any other windows, as well as the door, should be shut before beginning to observe: the nuisance may thus be sometimes abated; but the right place is unquestionably out of doors.

2. Do not wipe an object-glass or metallic speculum more than can possibly be helped. Hard as the materials are, scratching is a very easy process; and the ultimate result of ordinary wiping may be seen in an old spectacle-glass held in the sunshine. The most valuable part of a good telescope deserves much more careful treatment; and, if protected from dust and damp, it will very seldom require to be touched. Nothing but great carelessness would expose it to dust; and the dewing of the surface may be almost always avoided. The object-glass or speculum, if kept in a cold place, should not be uncovered, if possible, in a warmer air till it has gained something of its temperature; and it must be invariably closed up in the air in which it has been used before it is removed in-doors; or, in either case, it may be dewed like a glass of cold water brought into a heated room. The object-glass, however, being much exposed to radiation, requires additional protection; and this may be easily contrived. A tube of tin, pasteboard, or very thin wood, such as is used for hat boxes, or, best of all, calico stiffened with shellac and varnished, fitting on to the place whence the brass cap has been removed, and three or four times longer than wide, will, in general, keep the object-glass bright. The "dew-cap" must fit tight enough to stand firm, or it will bend down and intercept the light; but not so tight as to cause trouble in removing it to put on the brass cap in the open air. It is better to blacken its interior—indeed, necessary, if of tin; this may be done with lamp-black mixed with size or varnish, so as neither to show a gloss nor rub off; or a piece of black cloth or velvet may be glued or pasted inside it. A lining of blotting-paper is serviceable in heavy dew. A dew-cap on the finder will often save much trouble. Should it be necessary to leave the telescope for some time in the cold, a clean handkerchief thrown over the end of the dew-cap will be a complete safeguard. Should an object-glass or speculum become damp after all, do not close it up in that state; if the cloud of dew is very slight, it may quite disappear in a warm room, especially if exposed to a fire; if dense, however, it may leave a stain which ought to be quickly removed, as well as any little specks of dirt or dulness which will form, one knows not how. To do this, dust the dried surface first with a soft camel's hair pencil or varnishing brush, which will remove loose particles; then use, very cautiously, a very soft and even piece of chamois leather, which has not been employed for any other purpose, and must be always kept in a wide-mouthed stoppered bottle or wrapped up from dust; or a very soft silk handkerchief (which Lassell uses for glass) preserved with similar care. But the

*From advance sheets of "Webb's Celestial Objects for Common Telescopes."

wiping must be as gentle as possible; rubbing is inadmissable in any case. Proctor advises sweeping from a small space near the edge as a centre. Any refractory stains may be breathed upon, or touched with pure alcohol, and wiped till dry; but if the glass has become discolored, we must put up with the defect; and care should be taken not to mistake specks in the substance of the glass for foreign matters lodged on its surface. A slight tarnish may frequently be removed from a metallic speculum by lemon-juice, or a solution of citric acid, or spirit of hartshorn, carefully wiped off in a short time; if this does not restore its brightness, it is better to leave it alone; a slight loss of light is not so great an injury as would result from strong friction. The taking out or replacing of an object-glass or mirror is a delicate operation, and hurry or carelessness may easily make it a very dangerous one; speculum metal is nearly as brittle as glass: but this material is rapidly going out of use, from the superiority of the silver-on-glass mirrors, which are now becoming appreciated as they deserve. The management of these need not be described here, as special instructions should always accompany them, such as will be found in Browing's "Plea for Reflectors," or Calver's "Hints for Reflecting Telescopes."

Dimness of vision often results from damp on the eye-lens. This will rapidly disappear, without wiping, in a warmer temperature. If the finder does not act well, this may be suspected to be the cause. For these and many other reasons, a small lamp, the light of which can be concealed at pleasure, is a convenient adjunct to the telescope; any glass surface held at a safe height over it will speedily be cleared of moisture. A ground or papered glass front to a lamp is advantageous for reading.

Eye-piece lenses require occasional wiping; the leather may be pressed to their edges with a bit of soft wood. A piece of blotting-paper rolled to a point, and aided by breathing, answers perfectly. Their flat faces are easily scratched if laid downwards on a table. The screws demand very gentle usage: a previous turn backwards, before screwing in, causes the thread to fall with a snap into its place.

Hand-Turning.

I NEED scarcely insist on the actual necessity of everyone learning, first of all, to turn by hand. I have found the want of knowledge of the first rudiments of turning very much against the progress of anyone desirious of becoming an efficient. I know very many amateurs who can ornament a box well enough, for example—equal, in fact, to anyone who does such things professionally; but if they had to turn the box for themselves, it is certain it would not be ornamented at all. Therefore it is an absolute necessity for learners to begin at the beginning, and progress gradually to the various grades. Authors generally begin with soft-wood turning, and represent it as the most easy to accomplish. That it should be the first thing commenced on, I grant; but that it is the more easily acquired I do not admit. This, however, is a matter of opinion, and needs no discussion here; so to the point. In beginning, as a tyro, all that will be necessary is a plain lathe, the size or height of centre of which is of no consequence—but I should advise a 5 inch centre lathe—and the tools required will be simply a gouge, chisel, and parting-tool. The latter most people who essay to write upon this subject seem to ignore. I admit that a good deal of work can be detached with the edge of the chisel, but still the parting-tool is a necessary adjunct, and will be wanted. The wood I should recommend will be any soft wood, such as pine, mahogany, tulip, king, and many others of this class. Having arranged the tools and selected the materials, we will begin by placing upon the lathe the prong-chuck, which is made of metal, with a steel prong screwed into it. This part is made with a centre, and the flats filed down to the size of the largest end of the point, each side being then filed like a wedge, the bevel being, of course, to the rear. This, it will be obvious, will not allow of the two face-lines being diametrically opposite, as would be the case if

the prong were filed like a wedge, as in days gone by. It is a rule with some makers to have a gap each side of the point; but this is more to save labor than for any other purpose. Although the point is turned perfectly true, for the purpose of enabling the turner to place the work back, having removed it, it is the best plan to mark one side of the chuck, and so be certain that your work is running exactly as it was before taken from the lathe. Having found the centre of the wood and made a hole in the same, it may be driven into the prong by the aid of a hammer or mallet, care being taken not to split it. The popet-head centre, or, as it is commonly called, the back-centre, must be brought into use to support the end nearest to it. It is an old saying, and true, that position is everything, and it applies to turners, as in every other case; but a too-carefully studied pose may cause great discomfort to the operator. Therefore, provided it is not absolutely awkward, the position one feels most at home in will be found to be the most advantageous.

Should the wood be a very rough piece, or, say square, it will be advisable to take the corners off with an axe. The T-rest will be set rather higher than the centre. The gouge should have a long handle about 10 in., and the tool itself 8 in. This will be the proportion of what is called a three-quarter gouge. In the commencement, it should be held with a firm grip in the right hand, the left being placed on the top over the T-rest. If the left hand is in its proper position, which with a little practice it will assume, it will, by working the right hand from right to left, form a centre, so to speak. Before attempting to cut the wood, it would be as well to practice this movement for a short time. It must not be taken for granted that by moving the gouge as I have described, it will describe a curve; this will be obviated by raising the right hand gradually as it is worked either side of the so-formed centre, and it will, of course, only turn as much of the wood as the movement will allow; it must be then moved along the T-rest. I have turned a cylinder without the use of any other tool. It has been suggested by more than one author that the tyro's aim should be to turn a long cylinder, after the fashion of a ruler; but I should rather advise a novice not to set his mind upon accomplishing this feat, as not many can do it at all; by this I mean a cylinder perfect in every respect. The first day's work will be quite satisfactory if the pupil can rough-off a piece of wood, turning it fairly true, and without its flying out of the lathe several times. The second attempt should be diversified by the use of the chisel; but before taking advantage of this latter tool to smooth the work, endeavor to get it as smooth as possible with the former. The chisel is a flat tool, in some respects similar to others of the same name, but ground to a different form, being beveled on both edges and obliquely to the sides; the angle from side to side about 35 degrees. In using this tool, it is the centre of the cutting-edge that must be made the cutting part, except when shaping curves, or parting off any one part from the other. When passing it along a cylinder, it will require very great care to keep the corners from touching; if they do, it will run into the work after the manner of a quick screw, and do considerable damage—in some cases irreparable mischief. It must be held much after the manner of the gouge, and nothing but practice will overcome its difficulties.

Having gone sufficiently far with the cylinder to become tired of the same thing, we may now essay to turn various other forms, for example, an egg-cup. The convex part it will be obvious, must bring into use the chisel. The concave, or foot, will necessitate the gouge; for such work smaller tools will be better, and it will be advisable to have a selection, three or four of each—gouges and chisels, choosing those for use which appear to be the handiest. Here, again, there is no law as to size of the tool to be used, as some would prefer half an inch, others a three-eighth tool for the same purpose; therefore, as long as it will effect the purpose, that which is the most convenient should be chosen.—*J. H. Evans in English Mechanic.*

(To be continued.)

The Meaning of Dreams.

Lively dreams are, in general, a sign of excitement of nervous action; soft dreams, a sign of slight irritation of the brain, often, in nervous fevers, announcing the approach of a favorable crisis. Frightful dreams are a sign of determination of blood to the head. Dreams about fire are, in women, signs of impending hæmorrhage. Dreams about blood and red objects are signs of inflammatory conditions. Dreams about rain and water are often signs of diseased mucous membrane and dropsy. Dreams in which the patient sees any part of the body especially suffering, indicate disease in that part. Dreams about death often precede apoplexy, which is connected with determination of blood to the head. The nightmare (*incubus ephialtes*) with great sensitiveness, is a sign of determination of blood to the chest. "To these," says Baron Von Fechterleben, "we may add that dreams of dogs, after the bite of a mad dog, often precede the appearance of hydrophobia, but may be only the consequences of an excited imagination." Dr. Forbes Winslow quotes several cases in which dreams are said to have been prognostic: Arnaud de Villeneuve dreamed one night that a black cat bit him on the arm. The next day an anthrax appeared on the part bitten. A patient of Galen's dreamed that one of his limbs was changed to stone. Some days after his leg was paralyzed. Hippocrates remarks that dreams in which one sees black spectres are a bad omen.—*Dr. Hammond in Druggists' Circular.*

Dressing the Points of Draughting Pens.

The ability to sharpen a draughting pen and put it in complete order depends, in some measure, upon the skill and experience of the draughtsman, and the previous condition of the pen. If the pen has been worn too much, it would be much better to throw it aside and procure a new one. If it has not been worn or rusted to any very considerable extent, it may be easily sharpened as follows: In the first place, screw the blades up into contact and pass along the surface of an oil stone, turning upon the point in a directly perpendicular plane until the two plates acquire an identical profile. Next, unscrew the blades and examine them, in order to ascertain the parts of unequal thickness around the nib; then the blades are to be laid separately upon their backs on the stone and rubbed down at the points until they are brought up to an edge of uniform fineness. At this stage it is advisable to screw them together again and pass them once or twice more over the stone, in order to bring up any fault. After this they may be also touched on the outer and inner side to remove barbs or feather edge. Careful inspection of the instrument during this process, and the exercise of careful judgment, will enable any one to put a pair of draughting pens in good condition, provided, as we said above, they are not too badly rusted or worn out.—*Metal Worker.*

Coppering and Bronzing Zinc.

The following recipes for coppering and bronzing zinc are said to produce quite beautiful results: Prepare a solution of fifteen parts of blue vitriol and one of nineteen parts of cyanide of potassium, then mix both solutions together. Incorporate this liquid well with one hundred and sixty parts of pipe clay, and rub the resulting semi-fluid mass, by means of a linen rag, on the previously cleaned object. For bronzing, take fifteen parts of verdigris, nineteen of cream of tartar, and thirty parts of crystallized soda, reduce them to powder, and dissolve them in the necessary amount of water. Mix this liquid together with one hundred and sixty parts of pipe-clay, and proceed as above directed. Another process is as follows: Take fifteen grammes of blue vitrol, twenty of calcined soda, mix them well with thirty-two cubic centimetres of glycerine, and mix the paste obtained with eighty grammes of pipe-clay. It is then ready to be applied as before stated.

The Word "Gramme."

The general adoption of the French weights and measures by scientific writers in all parts of the world, has rendered the use of the word "gramme" of constant occurrence. We are extremely sorry to see that some of the young chemical writers in England have lately followed the American example of spelling the word "gram." It has been long ago observed that American writers have little respect for literary laws of any kind, and if their example were universally followed, philology and etymology, which are so useful to the historian and to the antiquary, would soon be things of the past. But in the present case the abbreviation of the word gramme is not only an example of needless bad taste, but it is also a dangerous vulgarity. More than once we have seen the most important errors committed in medical periodicals by confusing the said abbreviation with our English word *grain.* As there are fifteen English grains in a gramme, our readers will at once perceive the necessity of avoiding such dangerous confusion in medical and scientific literature by adhering to proper spelling.—*The Monthly Magazine.*

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

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To exchange, for engine or offers, a pair of Bliss Telephones and 200 feet of copper wire. J. W. Grant, 402 Broad St., Newark, N. J.

To exchange, a 2½ octave chromatic xylophone for microscope, microscopical apparatus, scientific books, or offers. J. E. Moore, Box 81, Newcastle, Ind.

I have McAllister's Naturalists' Microscope, with achromatic triplet objectives, used only 2 months, cost $12.00. I wish to exchange for an inch or 2-3 inch objective. Address, with particulars, F. F. Colwell, Urbana, Champaign Co., O.

To exchange for offers; a small lot of microscopic mounting apparatus. List on application to J. N. B., Box 1468, N. Y.

To exchange, books and Young Scientist, and trinkets, for other books, revolver, or stylographic pen. Frank Bicknell, Humboldt, Iowa.

Ancient petrified grain, Indian pottery, birds eggs, papers, magazines, Confederate money, fossils, minerals, to exchange for arrow-heads, Indian relics, Confederate, Continental, and other paper money. Fred T. Brinkerhoff, Box 347, Neenah, Wis.

Minerals, tricks, copper coins, book on pigeons and rabbits, Wilson School History, for book on experiments, or specimens, minerals, stamps or coins. P. R. Bradley, Box 305, Dunkirk, N. Y.

Wanted, a second-hand screw cutting foot lathe, must be in good condition; state what is wanted in exchange, also size and make of lathe. G. A. Clark, Castalia, Iowa.

To exchange, minerals, shells, fossil shells, birds eggs, etc., for minerals, shells, fossils, stuffed birds, birds eggs, and books. U. S. Grant, Des Moines, Iowa.

Wanted, botanical correspondents for the coming season, also amateur correspondents in chemistry. L, Box 70, East Templeton, Wov. Co., Mass.

Wanted, to exchange a well-equipped job printing outfit, for books or offers. Frank A. Niblack, Rockport, Ind.

Will exchange for Vol. 2 of the Young Scientist, instructive books bound in cloth to the value of $1.50. Chas. H. Williamson, 293 Eckford St., Greenpoint, Brooklyn, N. Y.

I have a new Munsen's battery, large size, which I wish to exchange for a good revolver or offers. Robt. T. Boyle, 351 West 83d St., New York.

Hair of American deer to exchange for diatoms, foraminifera, or other material. W. H. Osborn, Chardon, Ohio.

To exchange, full instruction in short-hand writing, and birds eggs, for birds eggs, postage stamps, or offers. M. F. E., 51 Spencer St., Albany, N. Y.

Wanted, specimens in geology, entomology, oology, etc., for those in other localities, also coins and a charm microscope (magnifies 1,000 times) for one having a different view. J. H. Jones, Frankfort, N. Y.

"History of Our Country," by Lossing, in six parts, price $15, to exchange for printing press or offers. Frank Chandler, Waverley, Mass.

Fine Devonian and Carb. fossils for others, especially cretaceous fossils, scientific books or papers; Pitman's short-hand works for books or offers. A. Stapleton, East Point, Tioga Co., Penn.

Wanted, scientific books and apparatus; send lists and say what is wanted in exchange. Ewing McLean, Greencastle, Ind.

Send for exchange list of insects, especially Coleoptera and Lepidoptera. Philip Laurent, 621 Marshall St., Philadelphia, Pa.

For printing press or offers, achromatic telescope, $8.50; microscope, $5; set drawing instruments, $3; revolver, $3; Phrenological Journal, $2.50; books, 12 plays, farces, dramas, burlesques, etc., $1.80. F. E. Payne, Alma, Mich.

One pair 3 lb Indian clubs, one scroll saw, one pocket lantern, and a large number of books, for magic lantern, pair telephones, photographic camera, or offers. Thos. A. Black, Lock Box 678, Scranton, Pa.

For exchange, pocket lantern and instruction books for cornet and clarionet; wanted History of the "Franco-Prussian War," and the "Lost Cause." C. W. Hughes, Shreve, Wayne Co., Ohio.

I have Brown's heavy scroll saw attachment, worth $6, which I wish to exchange for a lathe chuck or offers. C. B. Russell, Waterbury Centre, Vt.

Will exchange magnets, electric battery, as good as new, cost £3 in England, for plating battery and materials, or offers. F. Whitehead, Box 55, St. Augustine, Fla.

American and foreign coins to exchange; state what you have. W. J. Allen, 126 Twenty-third Street, Brooklyn, N. Y.

To exchange, fine imported game fowls of the best strain for Fleetwood scroll saw, compound microscope, telescope, magic lantern, shot gun, or offers. E. Alexander, Johnstown, Fulton Co., N. Y. Box 47.

J. T. Bell, Franklin, Pa., has set of ivory chessmen, German flute, six extra keys, value $12, books, etc., to exchange for magic lantern, music box, guns, revolvers, or offers.

Birds eggs and arrow-heads to exchange for fossils and minerals, and birds eggs; send for my list. Clement G. Burns, Salem, Col. Co., Ohio.

Minerals (zeolites, etc.), to exchange for other minerals; state what specimens you have to exchange. H. L. Clapp, 35 West Cottage St., Roxbury, Mass.

Type, in exchange for curiosities, fossils, etc. Geo. K. Fischer, 729 North 6th St., Philadelphia, Pa.

I have some stamps which I would like to trade for stuffed birds, birds eggs and nests; I am also open to an offer; send for list of stamps. A. G. G., Box 26, Summit, New Jersey.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

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Cutting Glass With a Hot Iron.

CERTAIN tramps, who are "hard up," periodically travel through the country, selling, as a great secret, directions for the old process of cutting glass with a red-hot iron. The method is very simple, and to those who have failed with the recipes usually published (strings wet with turpentine and set on fire; friction with strings, etc.) the results are rather surprising. We have never found any difficulty in cutting off broken flasks so as to make dishes, or to carry a cut spirally round a long bottle so as to cut it into the form of a corkscrew. And, by the way, when so cut, glass exhibits considerable elasticity, and the spiral may be elongated like a ringlet. The process, as we have just said, is very simple. The iron rod (a common poker answers very well) should be somewhat pointed, and the line along which the cut is to be made should be marked by chalk or by pasting a thin strip of paper alongside of it; then make a file mark to commence the cut; apply the hot iron and a crack will start; and this crack will follow the iron wherever we choose to lead it. In this way jars are easily made out of old bottles, and broken vessels of different kinds may be cut up into new forms. Flat glass may also be cut into the most intricate and elegant forms.

Sometimes it is not convenient to use a red-hot iron, and some persons fail in its use. In such cases carbon pencils or pastils may be used. They are made according to different recipes, of which we give three:

1. Dissolve 100 parts of gum arabic in 240 parts of water, and mix the solution with a paste prepared by triturating 40 parts of powdered tragacanth with 640 parts of hot water. Then, having dissolved 20 parts of storax and 20 parts of benzoin in 90 parts of alcohol (0·830), strain the latter solution and add it to the mixed mucilage. Finally mix the whole intimately with 240 to 280 parts of powdered charcoal, so as to

be uniform throughout. The charcoal should previously be passed through a fine sieve. The doughy mass is cut into suitable pieces, which are rolled between two boards dusted over with coal-dust, until cylindrical strips about 1 centimetre in thickness are formed, which are allowed to dry slowly between blotting-paper. When using them, one end is pointed like a lead pencil, and, after having previously made a scratch in the glass with a file or diamond, the heated and glowing end of the pencil is carried along the line in which the glass is intended to be fractured.

2. Dissolve 8 to 10 parts of tragacanth in about 100 parts of hot water, add to the mixture, under stirring, 30 parts of acetate of lead and 60 parts of finely-sifted beach-wood charcoal, and proceed as in the previous formula.

3. Sticks of soft wood (willow or poplar), of about the thickness of a finger, which must be thoroughly dry, are immersed for about one week in a concentrated solution of acetate of lead, after which they are again dried. When ignited these sticks burn like glazier's charcoal.

The first formula is that of Berzelius, and yields the best product, as it burns much slower than the others. These pastils maintain a more uniform heat than a hot iron, which is constantly getting cold.

Hand-Turning.—II.

(*Continued from page* 90.)

OUR remarks so far refer to such turning as may be accomplished between the centres of the lathe cylinders. We will now proceed to the turning of such articles as require to be turned out after the fashion of a bowl. The work must be chucked in a different form altogether; in some cases on a worm chuck, in others a cup-chuck may be more convenient. Now, to turn the face of a large diameter is quite a different thing from turning a cylinder; but having practiced the latter, the hand will have become used to the holding of the gouge, and the difference in position and angle of the tool necessary will, to a certain extent, suggest itself.

The T-rest will be now more convenient, if lowered, to allow of the cutting edge of the tool being brought nearly to the centre; the same motion as derived by the left hand being on the top of the tool and the right holding the handle, as in turning between centres, will now be obtained, only it will be applied to the surface. In turning out a bowl, for instance, the gouge must be turned on to its side until the left side becomes the upper part, and, according to the curve and depth of bowl required, the right hand must be moved to form the desired sweeep, and at the same time the gouge allowed to slide gradually through the left hand, which hand, although released to allow of this movement, must still retain sufficient hold, and not allow the tool to go where it is not wanted. I dare say, however, that it will insist upon taking a different course to that actually desired in the first few trials. I think we may turn our attention to the production of something useful in the shape of a box for some actual purpose, viz., for holding string. I start with this because it will give opportunity for further advance, as it will require several chuckings. Before beginning this, I think a few hours at screw-cutting will be of great service. Soft wood screws are generally made with what are termed screw boxes, which are to be had at all the tool shops, and are made from a very small size to the size of bench screws, about 2½ or 3 in. diameter. These, however, will not serve the purpose now requisite; therefore, a little practice and patience must be used, and I think it will be overcome. To begin with, when about to make anything that will require a screw, a wood of closer grain will be better, and I should choose a piece of good, sound, well-seasoned box-wood. In what we call striking a screw, the front edge of the wood should be rounded off, the screw tool held in right hand, with the thumb of left hand on the top over the T-rest, the hand itself passed round the body of the rest, and held firmly. A circular motion must be given with the right hand, and the centre part of the chaser will be that which first comes in contact with the work. It will only be after several trials that anything

resembling the run of a screw will appear; but by practice it will show itself, and must be then followed on to the part of the work where it is required. In case of a mishap, always leave the material both longer and larger in diameter than it will be wanted when finished, as the lead of a screw can generally be carried any length that may be required. Having practiced the chasing of an outside or male thread, we must turn our attention to the inside or female screw; the principle for this is just the same as in the former, the front of the wood must be rounded off, and the screw tool passed in and out, with a slight movement of the right hand, which must be worked from right to left, until the lead is obtained. In making a box make the lid first, and to do this, the piece of wood of which the whole thing is to be manufactured from should be carefully turned by aid of the prong chuck, to fit into one of the metal cup chucks, the size of course, being chosen to suit the material. The fitting should be slightly taper, and it can then be driven tightly in. Practically, the wood must not bottom—that is, a space between it and the end of the chuck is always left. It is as well to drive the wood into the chuck by placing it on a solid bench, and not to commence hitting it when on the mandril, although if not true, it may be corrected when in its place. The material now being properly held, the first step will be to determine the depth of the lid, and set the turner's square to it; then turn it out, taking care to have the inner surface perfectly flat; this done, take what is termed a hook tool, that is, a small tool turned at the end to a right angle, and rounded at the end. Insert this in the end, where the screw is to terminate, for the purpose of allowing the chaser to finish the screw without forming a ridge, or an unevenness, which will prevent the male screw going home to its place; having gone so far, the lid must be parted from the bottom, and it will be seen at a glance that the remaining portion, forming the bottom of the box, will act as a chuck upon which to finish the lid. The inside of the lower part can now be turned to its desired dimensions, and the outside screwed to fit the top; when this is done, the whole of the box can be turned off in one cut, and if the screws are properly fitted, it ought to be difficult to find the place where the two parts join. The outer shape may be ornamented by the application of a smaller chisel, and very pretty plain mouldings accomplished. I need scarcely mention that where large quantities of any special things of one particular shape are required, that a moulding-tool is made to the shape, and this, by being simply inserted, forms at once the shape, and insures their cut being exactly alike. I will now proceed a step further, and suggest that the next piece of work attempted should be what, for want of a better title, we will call a puzzle-box. This may sound somewhat *infra dig.*, but it will bear out its name in two senses: first, it will be a more difficult thing than might be imagined; secondly, if properly made, it will certainly puzzle anyone to extract its contents without being told how to do it. This box, in the first instance, shall take the shape of a ball—about the dimensions of a full-size billiard-ball will suffice. This, in itself, is no easy matter to accomplish, and it must be chucked several times in order to obtain a sphere; and if an opportunity should arise, I would ask anyone about to turn such an article to watch a billiard-ball turner for a little while, for although I am endeavoring to give all the information I can upon this subject, I candidly confess that a few hours' practical tuition is worth any amount of literature upon the same topic. We will presume, however, that the ball is completed. It must be chucked firmly, and a hole, slightly taper, turned right through it, about 1 in. diameter at the smallest end, and about 1-16th in. larger at the mouth. There is no rule for the sizes, and it matters little what they are. Having turned this perfectly straight and smooth, put it on one side, and turn a piece to fit it exactly. When this is done, the second part must be formed into a box, after the manner previously described. When this is so far finished, the box part is fitted into its place, and must be all turned off to the sphere as if it consisted of one piece only.

It will form a capital thing for practice, and, if well executed, will elicit great praise from any one who can appreciate good work. The next lesson will be to turn something in the shape of a vase from a pattern: the bare outline only will answer. It should be copied to such a nicety that it will be difficult to distinguish which is the original. For this purpose measuring instruments will be most essential, such as calipers, turner's square, before-mentioned, inside callipers, etc., etc. The production of two pieces of turning, one the facsimile of the other, is always considered a great achievement, and it should be practiced until overcome; and it may be taken for granted that the person who accomplishes such a thing is really a good turner. Having reached this stage of perfection, there is no reason why the slide-rest should not be now brought into use, although for soft-wood turning such an instrument is seldom used; but we will go a step beyond this material and try some of a closer grain and harder substance. Whatever the wood may be, if the slide-rest is to be employed, a gouge-cutter bar should be the tool used for roughing down the material. Now, with the assistance of both slide-rest and cutter-bar, the difficulty of turning a cylinder, whether it is for a ruler or any other purpose, will be reduced to a minimum, and will require very little practice; it will also become an easy matter to shape up whatever may be wanted, by using both handles of the slide-rest simultaneously. For turning out a deep recess, the slide-rest will be found a most useful tool, and will enable the operator to accomplish the work with more speed.

I think it will be useful to give a few hints upon making boxwood or other chucks. To make these, two taps and a chase will be required, also a half-round bit, the latter being made to the exact size of the bottom of the thread, and the taper or marking-off tap should be made to just enter and be taper. The thread must be cut up sharp at the point as well as the rear, because if filed off as taper taps generally are, the point will be flat instead of sharp, consequently the chaser will not readily find its proper starting point, the marking being a broad instead of a fine cut. Having bored the hole with the standard bit, mark off the thread with the taper, or first tap, and then chase the screw until the full-size tap will just enter, and then gently force the plug through the hole, and the tap being a counterpart of the mandril nose, made to cut, the chucks will fit on their place without further trouble. This is the manner in which amateurs should accomplish this most useful branch of turning. We, in the manufacture of best lathes, always cut the chucks in a self-acting lathe, but as few have the advantage of these useful, although expensive, tools, the above-mentioned plan is the handiest way to overcome the difficulty. Some workmen can strike off the screw without the aid of taps and bit, but unless great proficiency has been obtained, I should advise the use of the means described. A very useful addition to the lathe, especially for any one who is at all fond of carpenter or joiner's work, will be, what is termed, a pad chuck. This is made exactly after the fashion of that part of a carpenter's brace into which the centre bits fit, and they are held in their place by a spring and catch. The spring being pressed down, the tools are easily removed. For boring large holes in flat surfaces, this chuck will be extremely handy.

It remains at present only to say that it will be futile to anticipate reaching a high standard of perfection in the art, unless the rudiments are thoroughly learnt and practiced before venturing upon anything approaching ornamental work that requires special tools.—*J. H. Evans in English Mechanic.*

TEA TWO HUNDRED YEARS AGO.—The London *Gazette* of December 16, 1680, has the following: "These are to give notice to persons of quality that a small parcel of most excellent tea is by accident fallen into the hands of a private person to be sold; but, that none may be disappointed, the lowest price is 30 shillings a pound, and not any to be sold under a pound weight, for which they are desired to bring a convenient box. Inquire at Mr. Thos. Eagle's, at the King's Head, in St. James' Market."

Three Amateur Workers—and What They Did—XI.

BY FRED. T. HODGSON.

WE find Mr. Carpenter and the boys in their snug shop hard at work preparing the various pieces for the umbrella stand. It was decided to make it of ash—not because that wood was any better for the purpose than oak, walnut, or chestnut, but because it happened to be the most convenient to obtain in their locality. Two posts, 2 feet 3¾ inches long by 1½ x 1¼ inches, were prepared, and made straight, square, and true. Two pieces of stuff, ¾ of an inch thick, and 8 inches wide, and 2 feet 3¾ inches long, were prepared, being cut out at the top, same as shown at Fig. 41, with the scroll saw. It will be noticed that centre beads are run down at regular distances where each ornament starts at the top of the back. A tongue is wrought on one edge of each of these pieces. These tongues are designed to fit in a corresponding groove in the posts, and are there glued solid and firm. The pieces are also glued together at the central joint.

The little turned knobs at the top of the posts are two inches and a quarter long to the shoulders, and were obtained at the nearest turning shop for a few cents. A pin, about half an inch in diameter, was left on the lower end of each ornament, and a corresponding hole was bored in the top end of each post. In this hole the pin on the end of knob was inserted and glued. The rod running across the stand is turned out of stuff about one inch square, and is sixteen inches between the shoulders. Pins about ⅝ in diameter are turned on each end; these are glued into holes made in the brackets. The little knobs on the outside also have pins turned on them. They also are glued into the brackets on the outside. The posts are chamfered on the front corners, that is, the sharp corners or arrises are taken off about a quarter of an inch each way.

The top brackets are 9½ inches at their greatest width, and they run down the posts exactly one foot; they are made of seven-eighths stuff, and are fastened to the posts with screws and glue. The screws are two inches long, and are run through the posts from the back, the thread of the screws going into the back edges of the brackets.

The lower brackets are made of stuff the same thickness as the upper ones, and are 7 inches wide at their greatest width, and run up the posts 5¼ inches; screws and glue are used to fasten them to the posts and shelf, same as the upper brackets.

The shelf is 8¼ inches wide, and 18¼ inches long; it is chamfered on the front and two ends on the top corners. It must be notched out where it fits round the posts, so as to let the back edge fit snug against the back-board. The back-board is fastened to the edge of shelf with 1½ inch screws, about five of them being employed for that purpose. The under side of shelf is set up just two inches from the lower end of the posts, thus making the ends of the posts answer for two back feet, while the two front ones are formed out of stuff the same thickness as the brackets. The feet measure two inches from the shelf, to which they are fastened by screws and pins to the floor line or bottom.

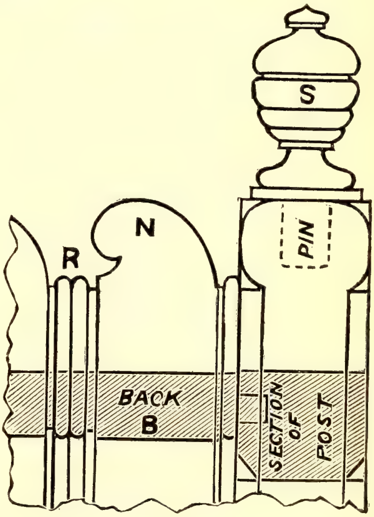

Fig. 42.

Fig. 42 shows the end of the post with the turned ornament, s, on the top. The dotted lines show the pin on the end of

the ornament, and the mode of fastening it to the top of the post. A shows a section of the post with the groove in it to receive the back; it also shows the "chamfers" on the two front corners. B shows a section of the back, showing the tongue that fits into the groove in the post; the centre beads and quirks are also shown. At N is shown the form of finish at the top of back. These forms are made with the aid

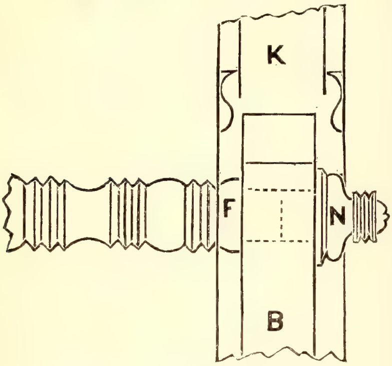

Fig. 43.

of the scroll saw. R shows how the beads are finished at the top of the back between the large ornaments. Mr. Carpenter procured a quarter-inch centre-bead plane, for working the beads on the surface, at a cost of seventy-five cents, and Fred found no difficulty in applying it. The tops of

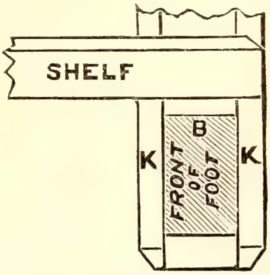

Fig. 44.

the beads, across the end wood were worked out with a sharp chisel, after being sawed down with a fine saw.

Fig. 43 shows a portion of the post K, and a part of the bracket B, with the turned rod F, and the ornament N. The dotted lines show the pins both on the rod and ornament. It is not necessary that the rod be turned exactly the shape as shown, but it is imperative that the distance between the shoulders thereof be precisely as given.

Fig. 44 shows a portion of the front edge of shelf with chamfer on top corner. B shows front edge of foot, and K K shows a part of the post.

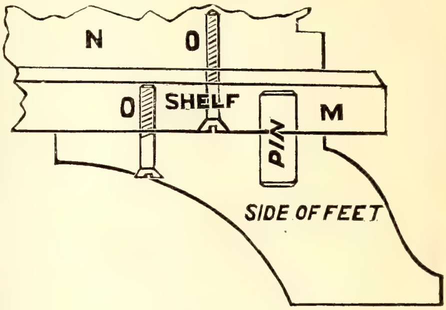

Fig. 45.

Fig. 45 shows the shape of the foot, and the method of fastening it to the shelf M. The screw O, goes through the shelf M, into the bracket N, the head being covered by the edge of the foot.

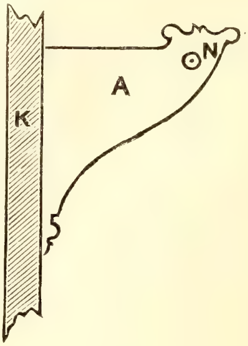

Fig. 46.

Fig. 46 shows the post K, and the shape of the upper bracket A. The ornament, N, is glued in place, and the centre of it is exactly 7⅝ inch from the post. At Fig. 47 the shape of the lower bracket N, that fastens on the shelf M, and the post K, is shown. The method of fastening the bracket to shelf and post, and the end of shelf, are also shown.

Everything being ready, and the glue made good and hot, Fred and Ellwood, under the direction of their father, began

to put the work together, an undertaking that the boys had looked forward to with considerable anxiety for some time. The back was glued together, and the posts driven on to the edges of the back; next, the turned rod was glued into the upper

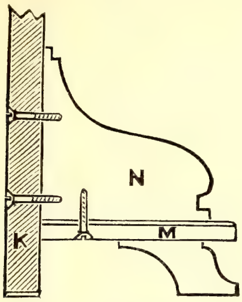

Fig. 47.

brackets, and the latter were then screwed and glued to the posts. Then the shelf was fastened from the back, and the lower brackets and feet attached and properly fastened; and lastly, the turned ornaments were glued and then driven in their places, and for the first time the "Umbrella Stand" stood on its feet. To Jessie, who had watched the operation throughout, the result seemed like a piece of magic, and her eyes fairly gleamed with astonishment. The boys, too, felt as though they had achieved something wonderful, and felt more important than ever they did before. Of course Mamma had to be informed of the result, and Jessie performed that duty almost instanter.

"Now, boys," said Mr. Carpenter, "we will let our work stand until to-morrow night, before we do any more to it, and by that time the glue will be 'set,' and then we will finish it; so let us leave work for to-night."

Common Telescopes.—IV.*

THE MODE OF OBSERVATION.

BRASS-WORK should not be rubbed with polishing powder, which might injure the lacquering; ammonia is preferable.

3. If the telescope does not seem altogether right, notwithstanding all the pains you can take in bringing it to focus, do not meddle with screws or adjustments, unless you thoroughly understand the construction, or can obtain good directions. In most cases a screw driver is a dangerous tool in inexperienced hands.

4. Do not use any part of a telescope or stand roughly, or expose it to any blow or strain. It is a delicate instrument, and well deserves careful preservation.

5. Do not spare trouble in adjusting the focus. It is well known that different eyes require a change, sometimes a great one; and the same observer's focus is not invariable, being affected by the temperature of the tube and the state of the eye, the adjustment of which, as Dawes has pointed out, shortens with intense gazing, and is apt to vary with the relative brightnesses of objects, besides being, to a certain extent, under the observer's control.

6. Do not over-press magnifying power. Schroter long ago warned observers against this natural practice, which is likely to lead beginners into mistakes. A certain proportion of *light* to *size* in the image is essential to distinctness; and though by using a deeper eye-piece we can readily enlarge the size, we cannot increase the light so long as the aperture is unchanged; while by higher magnifying we make the inevitable imperfection of the telescope and the atmosphere more visible. Hence the picture becomes dim and indistinct beyond a certain amount of power, varying with the brightness of the object, the goodness of the telescope, and the steadiness of the air. Comets and nebulæ, generally speaking, will bear but little magnifying. For the moon and planets, the power should be high enough (if the weather is suitable) to take off the glare, low enough to preserve sufficient brightness and sharpness; the latter condition being preserved, minute details are likely to come out better with an increase of power. Stars bear much more magnifying, from their intrinsic brilliancy; and they are enlarged very slightly in proportion; their images ought never, with any power, to exceed the dimensions of minute discs—*spurious discs*, as they are termed, arising from the undulatory nature of

*From advance sheets of "Webb's Celestial Objects for Common Telescopes."

light, and usually smallest in the best telescopes. A very high power has, however, so many disadvantages, in the difficulty of finding and keeping the object, the contraction of the field, the rapid motion of the image (in reality, the magnified motion of the earth), and the exaggeration of every defect in the telescope, the stand, and the atmosphere, that the student will soon learn to reserve it for special objects and the finest weather, when it will sometimes tell admirably. A very low power is apt to surround bright objects with irradiation, or glare. Experience in all these matters is the surest guide.

It may be very useful to know the diameter of the field of each of our eye-pieces. This may be obtained from the time which an object in or very near the equator takes in passing *centrally* through it; any star having but little declination will answer (γ *Virginis* and δ *Orionis* may be especially mentioned) or the moon or a planet in a corresponding position. Several trials may be made, and the mean result in minutes and seconds of time multiplied by 15 will give the diameter of the field in minutes and seconds of arc, or space, at the equator.

7. Do not be dissatisfied with first impressions. When people have been told that a telescope magnifies 200 or 300 times, they are often disappointed at not seeing the object apparently larger. In viewing Jupiter in opposition with a power of only 100, they will not believe that he appears between two and three times as large as the moon to the naked eye; yet such is demonstrably the case. There may be various causes for this illusion—want of practice—of *sky-room*, so to speak—of a standard of comparison. A similar disappointment is frequently felt in the first impression of very large buildings; St. Peter's at Rome is a well-known instance. If an obstinate doubt remains, it may be dissipated forever when a large planet is near enough to the moon to admit of both being viewed at once - the planet through the telescope, the moon with the naked eye.

8. Do not lose time in looking for objects under unfavorable circumstances. A very brilliant night is often worthless for planets or double stars, from its blurred or tremulous definition; it will serve, however, for grand general views of bright groups or rich fields, or for irresolvable nebulæ, which have no outlines to be deranged; a hazy or foggy night will blot out nebulæ and minute stars, but sometimes defines bright objects admirably; never condemn such a night untried. Twilight and moonlight* are often advantageous, from the diminution of irradiation. Look for nothing near the horizon, unless, indeed, it never rises much above it; nor over, or to the leeward of a chimney *in use*, unless you wish to study the effect of a current of heated air. If you catch a really favorable night, with sharp and steady vision, make the most of it; you will not find too many of them. Smyth, who thinks our climate has been unfairly depreciated, says: "Where a person will look out for opportunities in the mornings as well as evenings, and especially between midnight and daybreak, he will find that nearly half the nights in the year may be observed in, and of these sixty or seventy may be expected to be splendid." But ordinary students must of course take their chance, with their fewer opportunities. With due precaution as to dress, nothing need be feared from "night air;" that prejudice is fully confuted by the well-known longevity of astronomers, even of such as have habitually protracted their watchings

Till the dappled dawn doth rise.

9. In examining faint objects, do not prepare the eye for seeing nothing, by dazzling it immediately beforehand with a lamp, or white paper. Give it a little previous rest in the dark, if you wish it to do its best.†

10. When a very minute star or faint nebula is not to be seen at once, do not give it up without trying *oblique* or *averted vision*, turning the eye towards the edge

*Secchi has found the detail of the Great Nebula in Orion much more visible in moonlight, which is also known not to obliterate even such objects as the satellites of Mars and Uranus, or some of the minuter *comites* of double stars.

†Herschel II, when about to verify his father's observations on the satellites of Uranus, prepared his eye with excellent effect, by keeping it in utter darkness for a quarter of an hour.

of the field, but keeping the attention fixed on the centre, where the object ought to appear; this device, with which astronomers are familiar, is often successful; its principle depends probably on the greater sensitiveness of the sides of the retina.

11. Do not avoid the trouble of recording regularly all you see, under the impression that it is of no use. If it has no other good effect, it tends to form a valuable habit of accuracy; and you might find it of unexpected importance. And, like old Schroter, *trust nothing to memory.* If there has been haste—and sometimes if there has not—it is surprising what unforseen doubts may arise the next day; make at least rough notes at the time, and reduce them speedily into form, before you forget their meaning.

12. Do not be discouraged, by ignorance of drawing, from attempting to represent what you see. Everybody ought to be able to draw; it is the education of the eye, and greatly increases its capacity and correctness; but even a rough sketch may have its use; taken on the spot, and compared with the original, it will not be all untrue; it may secure something worth preserving, and lead to further improvement.

In conclusion, may I be permitted to remind the young observer not to lose sight of the immediate relation between the wonderful and beautiful scenes which will be opened to his gaze, and the great Author of their existence? In looking upon a splendid painting, we naturally refer its excellence to the talent of the artist; in admiring an ingenious piece of mechanism, we cannot think of it as separate from the resources and skill of its designer; still less should we disconnect these magnificent and perfect creations, so far transcending every imaginable work of art, from the remembrance of the Wisdom which devised them, and the Power which called them into being. Such is eminently the right use of the telescope—as an instrument, not of mere amusement or curiosity, but of a more extensive knowledge of the works of the Almighty. So new an aspect as has thus been given to the material universe—so amazing a disclosure as has thus been permitted to man, of the vastness of his Maker's dominion—can hardly be ascribed to blind accident or human contrivance; in thus employing Galileo's invention, we may well feel his grateful acknowledgment, that it was the result of the "previous illumination of the Divine favor,"* to have been not only beautiful but true.

How to Blow Birds' Eggs.

BY ALEXANDER G. GIBBS.

THERE are very few collectors who are not familiar with the old method of blowing birds' eggs, which consisted in making a hole with a pin in each end of the egg, then holding the egg between the thumb and forefinger and blowing steadily through one hole, forcing the contents through the hole in the other end. For the modern, and more scientific way, we must obtain the following instruments:

1. Several egg drills of different sizes.
2. One or two blow-pipes.

These instruments may be obtained from any taxidermist or dealer in naturalists' apparatus.

Having collected our instruments, and secured a specimen, we proceed as follows: Hold the egg between your thumb and finger, or lay it on a table, as may be preferred; place the sharp point of the drill against the shell, then twirl it between your fingers, taking care not to press hard enough to break the egg. After the hole is made, insert the smallest end of the blow-pipe, and blow steadily through the largest end, letting the contents ooze out around the blow-pipe. Of course the hole must be a little larger than the blow-pipe, to allow the contents to escape therefrom.

We have now got our egg blown; the next thing to do is to remove any stains there may be on the shell. First obtain a basin of luke-warm water and a soft rag; dip the egg in the water, and then apply the rag to any stains remaining on the shell, rubbing them carefully until you have succeeded in erasing all of them. The egg is now ready for your collection.

But there are two circumstances which may occur, and for which provision must

*Divina prius illuminante gratia.

be made. 1. The egg may contain an embryo. 2. Suppose the egg may get cracked or broken during the operation of blowing it.

If the former is the case, you must remove the embryo, if possible. There are several ways of doing so, the usual one being to obtain a small pair of scissors with long thin blades, and, inserting them through the hole, cut the embryo to pieces, and hook it out with a crooked pin or some such instrument. There is also another way of which I have read, but I would not advise any collector to attempt it, especially with a rare egg. This is to paste a piece of paper over the hole in the egg, first making a corresponding hole in the paper to fit the one in the egg; then lay the egg on an ant hill and the ants will do the rest—i.e., eat the embryo and leave the shell; but you must be sure and paste the paper on as above described, or the ants will be likely to eat the shell around the hole, and so spoil it for a good collection. If the egg should be cracked, you had better mend it as soon as possible, or you will run the danger of cracking it more. There is a certain cement used for this purpose, but I have never tried it, as I have always mended my cracked or broken eggs in this simple way: Put a thin strip of tissue paper or court plaster (white would be best) and paste it over the whole length of the crack, or enough to prevent it from cracking more.

Filing Saw Teeth.

Most amateurs find great difficulty in keeping their saws in good order. The following directions will be found valuable, although some of them apply only to larger saws than are likely to be used by amateurs. They have been prepared by Mr. J. E. Emerson, member of a well-known firm of saw manufacturers:

The greatest wear of a saw is on the under sides of the teeth. File nearly to an edge (but not quite), leaving a short bevel of say 1-32 of an inch wide on the under side of the point. But in no instance file to a fine point and thin wire edge.

1st. Be sure that the saw hangs properly on the mandrel.

2d. The saw must be in proper line with the carriage, and the carriage run true.

3d. The mandrel must be level and run tight in the boxes.

4th. Round off the saw so that all teeth will cut the same amount, and be sure that the very points of the teeth are widest.

5th. Do nearly all the filing on the upper sides of the teeth, and see that they are well spread at the points; file square, and have them project alike on both sides of the saw.

6th. If the saw heats in the centre when the mandrel runs cool in the boxes, cool it off and line it into the log a little.

7th. If the saw heats on the rim and not in the centre, cool it off and line it out of the log a little.

8th. Do not try the experiment of bending each alternate tooth for the set, when using inserted toothed saws.

9th. File the teeth hooking, so that the swage will spread them at the points.

10th. Use a light hammer in swaging, say three-quarters to one pound weight.

In filing solid toothed circular saws, keep the throats or roots of the teeth round, or as the saws are when new. Angles, or square corners, filed at the roots of the teeth, will almost invariably cause a saw to crack; the filing of such angles or square corners will cancel the warrant on any saw. The back or top of the tooth leads or guides the saw, and should be filed square across. These directions, if carefully followed, will put the saw in excellent condition for cutting, and serve to keep it true in circumference, and even in balance.

Luminous Paint.

The London *Building News* says: "The comparatively recent discovery that luminous paint can be applied as ordinary whitewash, considerably expands the field of its usefulness. Sheets of glass coated with the paint form Aladdin's lamps, which are in use in some of the vessels of the navy, at the Waltham Powder Factory, at Youngs Paraffin Works, and in the spirit vaults of several docks; but now that, by increased production and the use of water as the medium, the cost is reduced by one-half, it will probably be extensively used for painting walls and ceilings. The ordinary form of oil paint has already been applied in many ways to clock-faces, to name-plates and numbers on house-doors, and to notice boards, such as 'mind the step,' 'to let,' etc. The paint emits light without combustion, and therefore does not vitiate the atmosphere. Several experimental carriages are now running on different railways, the paint being used instead of lamps which are necessary all day on account of the line passing through occasional tunnels. It is

reported that a paper at Turin called *Light*, is to appear shortly printed in ink, which will be luminous when darkness sets in. Who can say, indeed, that a policeman when smeared in this luminous composition, will not be sometimes visible on his beat at night?"

Blacking for Leather.

The following has been used for harness, and also for leather bags, boots, etc., and is said to be admirable, if carefully prepared: Ext. logwood, 2 oz.; potass. bichrom, 2 drachms; yellow pruss. potass., 2 drachms; powdered borax, 3 oz.; liq. ammonia, 2 oz.; shellac, 16 oz.; water, 1 gallon. Dissolve the extract in the water, heating the liquid to nearly boiling, then add the chromate and the prussiate of potash. After a deep rich blue color has developed, add the borax, and when it has dissolved add the shellac, and lastly the ammonia; keep the whole at a gentle heat, stirring until the smell of ammonia has gone. The solution of logwood must be heated nearly to the boiling point before the salts of potash are added, or only a dirty blue color will be obtained.

Iridescent Copper.

A new invention for coating iron and steel with iridescent copper, has been devised by Dr. Weil, of Paris, and is thus described in the *Revue Potytechnique*. First, thirty-five parts of crystallized sulphate, or an equivalent amount of any other salt of copper, are precipitated as hydrated oxide by means of caustic soda or some other suitable alkaline base: this oxide of copper is to be added to a solution of 150 parts of Rochelle salts, and dissolved in 1,000 parts of water; to this 60 parts of best caustic soda is to be added, when a clear solution of copper will be formed.

The object to be coppered is to be cleaned with a scratch brush in an alkaline bath containing organic matter, such as solution of malt, etc. It is then attached as a cathode, immersed in the coppering bath, and treated with the usual precautions, when it will become coated with an adherent film of metallic copper.

As the bath gradually loses its copper, oxide of copper, as above prepared, should be added, to maintain it in a condition of activity, but the quantity of copper introduced should not ordinarily exceed that above prescribed as compared with the quantity of tartaric acid the bath may contain. If the quantity of copper notably exceeds this proportion, certain metallic colors are produced on the surface of the object. These effects may be employed for ornamental and artistic purposes.

According to the time of the immersion, the strength of the current, and the proportion of copper to the tartaric acid, the iridescences may be produced of different shades and tints, which may be varied or intermingled by shielding certain parts of the object by an impermeable coating of paraffine or varnish, while the iridescent effect is being produced on the parts left exposed. All colors, from that of brass to bronze, scarlet, blue, and green, may thus be produced at will.

Practical Hints.

Oil on Woodwork.—Carefully-conducted experiments have demonstrated the fact that seasoned wood, well saturated with oil when put together, will not shrink in the dryest weather. Wheels have been known to run many years, even to wearing out the tires. Very many dollars might be saved annually if this practice was adopted. Boiled linseed oil is the best for general use, although it is now known that crude petroleum on even old wheels is of great benefit.

To Repel Mosquitoes.—Mr. Ivers W. Adams writes from Bathurst, N. B., to *Forest and Stream*, that he tried a dozen prescriptions for repelling mosquitoes, flies, and similar pests, and found none of them effective until he came across the following, which are dead sure every time:

"Three oz. sweet oil, 1 oz. carbolic acid. Let it be thoroughly applied upon hands, face, and all exposed parts (carefully avoiding the eyes) once every half hour, when the flies are troublesome, or for the first two or three days, until the skin is filled with it, and after this its application will be necessary only occasionally. Another recipe, equally efficacious, is: Six parts sweet oil, one part creosote, one part pennyroyal. Either of these is agreeable to use, and in no way injurious to the skin. We have both of these in our camp with us, and all flies keep a safe distance."

Paste.—A correspondent of *New Remedies* gives the following recipe for a paste for use in prescription books and labels:

"I dissolve half an ounce of alum in a pint of boiling water; to this I add an equal weight of flour, made smooth in a little cold water, and a few drops of oil of cloves, letting the whole come to a boil. This paste will keep months. I put it in glass, or ordinary ointment jars. This paste is handy, too, for domestic purposes. My children have many toys that come in wooden boxes, but these will break at the corners and soon come to pieces. When a box begins to give out, I take a piece of cambric or calico, and with the brush and paste cover the box so that it will bear constant usage for months. Then, if the cover gives out, I pull it off and put on another one. Again, a doll's arm or leg comes off; but a piece of muslin and a bit of paste restores the article, so that it is as good as it was before."

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business letters or cards they cannot be used.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

To exchange, Hugh Miller,s "Cruise of the Betsey," and "The Old Red Sandstone," cloth bound geological books, for lathe, hammock, or "Gray's Manual of Botany." Gus. C. Spaeth, Mt. Carmel, Ills.

F. F. F., Lock Box 83, St. Johnsbury, Vermont, would like to exchange or correspond with persons interested in mineralogy, Oology, philatology, Indian relics, books, entomology, numis matology, etc.

Wanted, a good printing press and type; state what is wanted in exchange. H. A. Kinney, Hamlin, Brown Co., Kansas.

I have a printing press and outfit (cost $15) to exchange for books, microscope, tent, watch, or offers. Henry E. Jacobs, 59 Harvard Street, Boston, Mass.

I have Vols. 2 and 3 of "Nests and Eggs of American Birds," to exchange for Vol. I of YOUNG SCIENTIST, or offers. N. B. Stone, Lock Box 9, Putnam, Conn.

Wanted, a printing outfit or offers, in exchange for baritone cornet, air gun, and other things, a list of which will be furnished upon application. E. S. Nixon, Jr., Box 345, Chattanooga, Tenn.

To exchange, minerals, ores, shells, papers, magazines, books, coins, stamps, for stamps, coins, minerals, stylographic pen, telephone, etc. A. M. Beveridge, P. O. Box 854, Appleton, Wis.

Will exchange minerals for other minerals; state what specimens you desire. E. A. Refsnyder, Phœnixville, Chester Co., Pa.

Wanted, a good powerful second-hand microscope; forward engraving of instrument, stating price, or what is wanted in exchange. L. D. Snook, Barrington, Yates Co., N. Y.

Wanted, botanical specimens of Western, West C ast, and Southern ferns, in exchange for Northern species; lists exchanged. H. N. Johnson, Coeymans, N. Y.

Wanted, copy of "Snowball's Elementary Natural Philosophy." M. B Tausy, Harrisburg, Pa.

A German microscope, with 3 objectives and 5 eye-pieces, condensing lens, etc., resolving Pleurosigma angulatum, will be exchanged for a first-class spectroscope. Clarence L. Speyers, 50 West 17th St., New York.

A new 2x4 engine, worth $60, for a first-class bicycle; also a watch, revolver, and gas stove, for a 6x9 printing press, type, or offers. Geo. L. Lamson, La Fargeville, N. Y.

To exchange, specimens in botany, oology, etc., for those in other localities; botanical correspondents desired. Arthur Fairbanks, St. Johnsbury, Vt.

Te exchange, for other books on scientific and industrial subjects, "Moore's Universal Assistant," "The Young Mechanic;" both quite new. Fred. Whitehead, Box 55, St. Augustine, Fla.

I have a fine concert harmonica, 20 notes, with case, but little used, that I will exchange for Vol. 3, of the YOUNG SCIENTIST. Charlie O. Wells, Hatfield, Mass.

To exchange, birds' eggs and minerals, for minerals, ores, and curiosities. H. G. Emery, 51 Spencer St., Albany, N. Y.

To exchange, for engine or offers, a pair of Bliss Telephones and 200 feet of copper wire. J. W. Grant, 402 Broad St., Newark, N. J.

To exchange, a 2½ octave chromatic xylophone for microscope, microscopical apparatus, scientific books, or offers. J. E. Moore, Box 81, Newcastle, Ind.

I have McAllister's Naturalists' Microscope, with achromatic triplet objectives, used only 2 months, cost $12.00. I wish to exchange for an inch or 2-3 inch objective. Address, with particulars, F. F. Colwell, Urbana, Champaign Co., O.

To exchange for offers; a small lot of microscopic mounting apparatus. List on application to J. N. B., Box 1468, N. Y.

To exchange, books and YOUNG SCIENTIST, and trinkets, for other books, revolver, or stylographic pen. Frank Bicknell, Humboldt, Iowa.

Ancient petrified grain, Indian pottery, birds eggs, papers, magazines, Confederate money, fossils, minerals, to exchange for arrow-heads, Indian relics, Confederate, Continental, and other paper money. Fred T. Brinkerhoff, Box 347, Neenah, Wis.

Minerals, tricks, copper coins, book on pigeons and rabbits, Wilson School History, for book on experiments, or specimens, minerals, stamps or coins. P. R. Bradley, Box 305, Dunkirk, N. Y.

Wanted, a second-hand screw cutting foot lathe, must be in good condition; state what is wanted in exchange, also size and make of lathe. G. A. Clark, Castalia, Iowa.

To exchange, minerals, shells, fossil shells, birds eggs, etc., for minerals, shells, fossils, stuffed birds, birds eggs, and books. U. S. Grant, Des Moines, Iowa.

Wanted, botanical correspondents for the coming season, also amateur correspondents in chemistry. L, Box 70, East Templeton, Wov. Co., Mass.

Wanted, to exchange a well-equipped job printing outfit, for books or offers. Frank A. Niblack, Rockport, Ind.

Will exchange for Vol. 2 of the YOUNG SCIENTIST, instructive books bound in cloth to the value of $1.50. Chas. H. Williamson, 293 Eckford St., Greenpoint, Brooklyn, N. Y.

I have a new Munsen's battery, large size, which I wish to exchange for a good revolver or offers. Robt. T. Boyle, 351 West 83d St., New York.

Hair of American deer to exchange for diatoms, foraminifera, or other material. W. H. Osborn, Chardon, Ohio.

To exchange, full instruction in short-hand writing, and birds eggs, for birds eggs, postage stamps, or offers. M. F. E., 51 Spencer St., Albany, N. Y.

Wanted, specimens in geology, entomology, oology, etc., for those in other localities, also coins and a charm microscope (magnifies 1,000 times) for one having a different view. J. H. Jones, Frankfort, N. Y.

"History of Our Country," by Lossing, in six parts, price $15, to exchange for printing press or offers. Frank Chandler, Waverley, Mass.

Fine Devonian and Carb. fossils for others, especially cretaceous fossils, scientific books or papers; Pitman's short-hand works for books or offers. A. Stapleton, East Point, Tioga Co., Penn.

Wanted, scientific books and apparatus; send lists and say what is wanted in exchange. Ewing McLean, Greencastle, Ind.

For printing press or offers, achromatic telescope, $8.50; microscope, $5; set drawing instruments, $3; revolver, $3; Phrenological Journal, $2.50; books, 12 plays, farces, dramas, burlesques, etc., $1.80. F. E. Payne, Alma, Mich.

The Young Scientist

SCIENCE IS KNOWLEDGE. KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

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How to Learn to Swim.

LET the learner choose for his first lessons a warm day, about noon, or, if he may be strong enough for it, in the morning, shortly after rising, having first partaken of a dry biscuit, or, in the evening, not later than, say eight o'clock. In no case should any one enter water sooner than, at least, seventy-five or eighty minutes after meals. Neither should bathing be indulged in when the body is perspiring profusely. The opposite extreme is as bad; no one can hope to enjoy a bath in cold water, if he has to enter it when the body is chilled. Many accidents occur to practiced swimmers for want of proper attention to the condition of the body and stomach when bathing.

Let the pupil bear in mind that, to be successful, there are three essentials, viz.:

Confidence in the buoyancy of the body when the proper motions are made.

Presence of mind to think on and perform the necessary movements.

Determination to learn.

Do not jump or dive from a height into the water until accustomed to the slight shock experienced by learners. Walk quickly into the water, until immersed to the middle of the body; turn the face to the shallow water, and duck the whole body and head by bending the knees, the one foot being behind the other. Have a friend to support the body by means of a strap, passed round the chest under the armpits, and meeting in the hollow between the shoulders. This can be done best by the teacher leaning over the stern of a small punt. In this position he can see every portion of the pupil's limbs, and can direct the movements very easily, without entering the water at all. Get the body into position by throwing the head well forward, lift the feet off the ground, and stretch the legs as far apart as possible. This position of the nether limbs gives them floating power, and keeps them close to the surface of the

water. To make the lesson simple, there are three motions of legs and arms, which are numbered, and must be accurately performed as follows:

With the arms—Bring the hands with the palms close together, in front of the chest and directly under the chin, the fingers pointing straight in front.

At "one," stretch the arms out to their full extent in front, the palms still close together, and the hands about two inches under the surface of the water.

At "two," separate the hands and turn the wrists slightly until the hands are lying flat on the water; now brace the wrists, and, without bending the elbows, bring the arms slowly round, describing with each a quarter circle, until hands, arms and shoulders are in a straight line across.

At "three," let the palms face toward the feet, and bring the hands in a straight line to the position whence they started. While this movement is being performed, the fingers should be pointed partly to the bottom of the pond and in a slanting direction toward the front.

Practice these movements until they are performed accurately. Now keep the hands in the third position, and practice the kick before beginning, which brings the feet close up to the body, toes and knees turned in the same direction outward.

With the legs—At "one," kick the legs out to their full extent, as wide apart as possible. Be sure, when practicing this part of the kick, to have the toes turned to the side outward, and keep the ankles perfectly stiff.

At "two," brace the knees, toes turned downward, and, without jerking, bring the legs together, joint for joint.

At "three," bring the feet close up to the body, the heels touching and the knees again turned to the side, the toes to be pointed sideways immediately the feet are close to the body.

Practice these movements slowly, distinctly, and separately, until each one is performed perfectly. Then begin the movements of arms and legs simultaneously as follows:

At "one," put the arms out in front, and kick the legs wide apart.

At "two," bring the arms round, describing the quarter circle, at the same time pulling the legs together until they touch.

At "three," return the hands to the original position, and bring the heels close up to the body, knees and toes turned out.

Work, with legs and arms in unison, slowly at first, and counting each movement. In a short time the motions will be performed quite mechanically, and, once they are learned, they are not easily forgotten.

The following hints in reference to the movements will be of some service to the advanced swimmer as well as to the learner:

While performing the first part of the kick, be sure the legs are as wide apart as possible from each other, the effort being made to kick sideways and backward, not downward. The reasons for this are obvious. In the first place, kicking downward gives an ungainly jerk to the body, spoiling the appearance of the stroke, and is also a waste of strength, as it sends the body, or part of it, out of the water, while every effort should be made to propel the body forward.

Number two of the kick is the most important motion of any, and, strange to say, the one most neglected by self-taught swimmers. It is actually the propelling power in swimming; for, when the legs are brought firmly together, the body is shot forward. Therefore, the wider the legs are kicked apart, and the firmer they are pulled together, the greater will be the speed attained. Every swimmer should have this constantly in mind.

The motions one and two of the legs should be performed in as nearly one movement as possible.

The instructions as to the movement of the ankle-joint, in number three, should be also borne in mind, as it is indispensable to perfection in swimming, and is done that there may be as little friction or resistance as possible when the feet are being returned to renew the stroke. The toes are turned out again, to allow of the feet being kicked out with less waste of strength than could otherwise be the case.

Do not hitch the body in any way; the limbs must do all the work. Keep the neck stiff, and make no effort to raise the head above the surface of the water beyond the motion of arms and legs. The weight of the head is diminished considerably when it rests on or in the water. The body and legs should be level, the head being very slightly raised.

Many swimmers experience difficulty in regulating the breathing. There should be no difficulty at all in breathing as regularly in the water as when walking on terra firma, once the first disagreeable feeling in learning it has been got over. The fastest and best of our living swimmers have the mouth and nostrils immersed in the water for at least two-thirds of the time they are swimming. This, along with the improved side and overhand stroke, accounts for the very fast swimming that is being performed, at the matches especially. The mouth and nostrils lie deepest in the water at the beginning of the stroke—that is, when the hands are being stretched in front, while they are raised just above the level of the water as the arms are brought around in the second position. Therefore, to breathe regularly the swimmer should exale or partly empty the lungs at once. This is easily done, although the mouth is under water. The lungs are then filled in an instant, quite easily, during the second part of the stroke. Be sure to breathe regularly every stroke, and never completely empty the lungs. Care must at first be taken not to open the mouth too soon, or water instead of air will be taken in. Presence of mind is essential to the learner. It is also indispensable to the best swimmer. Let the swimmer always bear in mind that, no matter how tired he may be, if not actually cramped, by turning on his back the slightest movement of legs or arms will support him on the surface of the water; or, take a good long breath, expand the chest, keep the head well back, and lie perfectly still; then he will have time to consider what had best be done. In all likelihood he will be sufficiently rested to resume the journey back again, if help has not arrived. One thing all swimmers should guard against: that is, not to allow themselves to go too far out with the current when the tide is ebbing. The best swimmers will find it hard work making headway against some currents. Another error to be guarded against is remaining in the water too long at a time. To practice swimming with a view to benefit by its healthful effects, the stay in the water ought not to be prolonged beyond from eight to ten minutes.

Marvels of Pond Life.

ONE of the most interesting books in the library of the amateur microscopist is the "Marvels of Pond Life," by Mr. Henry J. Slack, late secretary to the Royal Microscopical Society. This book deals entirely with microscopic forms of animal life, and the common experience of all microscopists confirms the assertion made by Dr. Goring, that the most fascinating objects are living creatures of sufficient dimensions to be easily understood with moderate magnification; and in no way can objects of this description be so readily obtained, as by devoting an occasional hour to the examination of the little ponds which are accessible from almost any situation. A complete volume of pond lore would not only be a bulky book, but its composition would overtask all the philosophers of our day. In good truth, a tea-spoonful of water from a prolific locality often contains a variety of living forms, every one of which demands a profound and patient study, if we would know but a few things concerning it.

There is an irresistible charm in the effort to trace *beginnings* in nature. We know that we can never succeed; that each discovery, which conducts back towards some elementary law or principle, only indicates how much still lies behind it: but the geologist nevertheless loves to search out the first or oldest traces of life upon our globe; and so the microscopist delights to view the simplest exhibitions of structures and faculties, which reach their completion in the frame and mind of man. That one great plan runs through the whole universe is now universally accepted truth, and when applied to physi-

ology and natural history, it leads to most important results.

Unfortunately, the book to which we have referred is somewhat scarce and therefore we feel that we are doing our readers a great service by reproducing it in these pages.

PLAIN HINTS ON MICROSCOPES AND THEIR MANAGEMENT.

The microscope is rapidly becoming the companion of every intelligent family that can afford its purchase, and, thanks to the skill of our opticians, instruments which can be made to answer the majority of purposes may be purchased for from $20 to $60, while even those of lower price are by no means to be despised. While the cheap instruments manufactured in quantities by those who do not even care to put their names on them will rarely give satisfaction, it will be found that the average production of respectable houses in England, France, Germany, and America, exhibit so high a degree of excellence as to make comparisons invidious. We shall not, therefore, indulge in the praises of particular firms, but simply recommend any reader entering upon microscopic study to procure an achromatic instrument, if it can be afforded, and having at least two powers, one with a focus of an inch or two-thirds of an inch, and the other of half or a quarter. Cheap microscopes have usually only one eye-piece, those of a better class have two, and the best are furnished with three, or even more.

The magnifying power of a compound microscope depends upon the focal length of the object-glass (or glass nearest the object), upon the length of the tube, and the power of the eye-piece. With regard to object-glasses, those of shortest focal length have the highest powers, and the longest eye-pieces have the lowest powers. The body of a microscope, or principal tube of which it is composed, is, in the best instruments, about nine inches long, and a draw tube, capable of being extended six inches more, is frequently useful. From simple optical principles, the longer the tube the higher the power obtained with the same object-glass; but only object-glasses of very perfect construction will bear the enlargement of their own imperfections, which results from the use of long tubes; and consequently for cheap instruments the opticians often limit the length of the tube, to suit the capacity of the object-glasses they can afford to give for the money. Such microscopes may be good enough for the generality of purposes, but they do not, with glasses of given focal length, afford the same magnifying power as is done by instruments of better construction. The best and most expensive glasses will not only bear long tubes, but also eye-pieces of high power, without any practical diminution of the accuracy of their operation, and this is a great convenience in natural history investigations. To obtain it, however, requires such perfection of workmanship as to be incompatible with cheapness. An experienced operator will not be satisfied without having an object-glass at least as high as a quarter, that will bear a deep eye-piece, but beginners are seldom successful with a higher power than one of half-inch focus, or thereabouts, and before trying this, they should familiarize themselves with the use of one with an inch focus.

It is a popular error to suppose that enormous magnification is always an advantage, and that a microscope is valuable because it makes a flea look as big as a cat or a camel. The writer has often smiled at the exclamations of casual visitors, who have been pleased with his microscopic efforts to entertain them. "Dear me, what a wonderful instrument; it must be immensely powerful;" and so forth. These ejaculations have often followed the use of a low power, and their authors have been astonished at receiving the explanation that the best microscope is that which will show the most with the least magnification, and that accuracy of definition, not mere increase of bulk, is the great thing needful.

Scientific men always compute the apparent enlargement of the object by *one* dimension only. Thus, supposing an object one hundreth of an inch square were magnified so as to appear one inch square, it would, in scientific parlance, be

magnified to "one hundred diameters," or one hundred linear; and the figures 100 preceded by the sign of multiplication (thus, × 100) would be appended to any drawing which might be made from it. It is, however, obvious that the length is magnified as well as the breadth; and hence the magnification of the whole surface, in the instance specified, would be one hundred times one hundred, or ten thousand: and this is the way in which magnification is popularly stated. A few moments' consideration will show that the scientific method is that which most readily affords information. Any one can instantly comprehend the fact of an object being made to look ten times its real length; but if told that it is magnified a hundred times, he does not know what this really means, until he has gone through the process of finding the square root of a hundred, and learnt that a hundredfold magnification means a tenfold magnification of each superficial dimension. If told, for example, that a hair is magnified six hundred diameters, the knowledge is at once conveyed that it looks six hundred times as broad as it is; but a statement that the same hair is magnified three hundred and sixty thousand times, only excites a gasping sensation of wonder, until it is ascertained by calculation that the big figures only mean what the little figures express. In these articles the scientific plan will always be followed.

If expense is not an object, a binocular instrument should be purchased, and it is well to be provided with an object-glass as low as three or even four inches focus, which will allow the whole of objects having the diameter of half an inch or more to be seen at once. Such a low power is exceedingly well adapted for the examination of living insects, or of the exquisite preparations of entire insects, which can now be had of all opticians. Microscopes which have a draw tube can be furnished with an *erector*, an instrument so called because it erects the images, which the microscope has turned upside down, through the crossing of the rays. This is very convenient for making dissections under the instrument; and it also gives us the means of reducing the magnifying power of an object-glass, and thus obtaining a larger field. The erector is affixed to the end of the draw tube, and by pulling it out, or thrusting it in, the rays from the object-glass are intercepted at different distances, and various degrees of power obtained.

A binocular microscope is most useful with low powers from two-thirds upwards. A new form, devised by Mr. Stephenson, acts as an erector, and is very valuable for dissections. It works with high powers.

Beginners will be glad to know how to obtain the magnifying power which different objects require, and it may be stated that, with a full-sized microscope, a two-inch object-glass magnifies about twenty-five diameters with the lowest eye-piece; a one-inch object-glass, or two thirds, from fifty to sixty diameters; a half-inch about one hundred; a quarter-inch about two hundred. The use of deeper eye-pieces adds very considerably to the power, but in proportions which differ with different makers. One instrument used by the writer has three eye-pieces, giving with a two thirds object-glass powers of sixty, one hundred and five, and one hundred and eighty respectively; and with a fifth, two hundred and forty, four hundred and thirty, and seven hundred and twenty, which can be augmented by the use of a draw tube.

It has been well observed that the illumination of objects is quite as important as the glasses that are employed, and the most experienced microscopists have never done learning in this matter. Most microscopes are furnished with two mirrors beneath the stage, one plane and one concave. The first will throw a few parallel rays through any transparent object properly placed, and the latter causes a number of rays to converge producing a more powerful effect. The first is usually used in daylight, when the instrument is near a window (one with a north aspect, out of direct sunlight, being the best); and the second is often useful when the source of illumination is a candle or a lamp. By varying the angle of the mirror the light is thrown through the object more or less obliquely, and its

quantity should never be sufficient to pain the eye. Few objects are seen to the best advantage with a *large* pencil of perfectly direct light, and the beginner should practice till he is able to obtain that arrangement which produces the best effect.

It is advisable that the hole in the stage of the microscope should be large—at least an inch and a half in diameter—so that the entrance of oblique rays is not obstructed, and it is desirable that the mirror, in addition to sliding up and down, should have an arm by which it may be swung to one side. This enables such oblique rays to be employed as to give a dark field, all the light which reaches the eye being *refracted* by the object through which it is sent. The opticians sell special pieces of apparatus for this purpose, but though they are very useful, they do not render it less desirable to have the mirror mounted as described.

Most microscopes are furnished with a revolving diaphragm, with three holes, of different sizes, to diminish the quantity of light that is admitted to the object. This instrument is of some use, and offers a ready means of obtaining a very soft agreeable light for transparent objects, viewed with low powers. For this purpose cut a circular disc of India or tissue paper, rather larger than the biggest aperture; scrape a few little pieces of spermaceti, and place them upon it, then put the whole on a piece of writing paper, and hold it a few inches above the flame of a candle, moving it gently. If this is dexterously done, the spermaceti will be melted without singeing the paper, and when it is cold the disk will be found transparent. Place it over the hole in the diaphragm, send the light through it, and the result will be a very soft agreeable effect, well suited for many purposes, such as viewing sections of wood, insects mounted whole, after being rendered transparent, many small water creatures, etc. Another mode of accomplishing this purpose is to place a similarly prepared disk of paper on the flat side of a bull's-eye lens, and transmit the light of a lamp through it. This plan may be used with higher powers, and the white opaque light it gives may be directed at any angle by means of the mirror beneath the stage.

An ordinary lamp may be made to answer for microscopic use, but one of the small hand lamps, now so common, is singularly convenient. It is high enough for many purposes, and can easily be raised by one or more blocks. A kerosene lamp on a sliding stand is still more handy, and all the better for a hole with a glass stopper, through which it may be filled.

Many people fancy that the eyes are injured by continual use of the microscope, but this is far from being the case if reasonable precautions are taken. The instrument should be inclined at a proper angle, all excess of light avoided, and the object brought into focus before it is steadily looked at. Most people solemnly shut one eye before commencing a microscopic examination; this is a practical and physiological mistake. Nature meant both eyes to be open, and usually resents a prolonged violation of her intentions in this matter. It requires but a little practice to keep both eyes open, and only pay attention to what is seen by that devoted to the microscope. The acquisition of this habit is facilitated, and other advantages gained, by a screen to keep out extraneous light. For this purpose take a piece of thin cardboard about nine inches square, and cut a round hole in it, just big enough to admit the tube of the microscope, about two inches from the bottom, and equidistant from the two sides. Next cut off the two upper corners of the cardboard, and give them a pleasant-looking curve. Then cover the cardboard with black velvet, the commonest, which is not glossy, answers best, and your screen is made. Put the hole over the tube of the microscope, and let the screen rest on the little ledge or rim which forms an ornamental finish to most instruments. A piece of cork may be gummed at the back of the screen, so as to tilt it a little, and diminish its chance of coming into contact with that important organ the nose. This little contrivance adds to the clearness and brilliancy of objects, and is a great accommodation to the eyes.

One more oculistic memorandum, and

we have done with this chapter. Do not stare at portions of objects that are out of focus, and consequently indistinct, as this injures the eyes more than anything. Remember the proverb, "None so deaf as those that won't hear," which naturally suggests for a companion, "None so blind as those that won't see." It is often impossible to get every object in the field in focus at one time;—look only at that which is in focus, and be blind to all the rest. This is a habit easily acquired, and is one for which our *natural* microscopes are exceedingly grateful; and every judicious observer desires to keep on the best terms with his eyes.

(To be continued.)

Three Amateur Workers—and What They Did—XII.

BY FRED. T. HODGSON.

ON the following evening, Mr. Carpenter, Fred, and Ellwood, were very busy finishing up the umbrella-stand.

Fred was sand-papering it all over with very fine sand-paper, and, as the work was not to be stained or painted, he was very careful in rubbing lengthwise of the grain, for his father had cautioned him not to rub across the grain, as that would leave marks and scratches that would show through the varnish.

Mr. Carpenter was engaged putting on, with short screws, a piece of hoop-iron about an inch wide, to the back of the stand. This hoop-iron had six holes in it, one in each end that permitted of a screw being put in each part, and four screws were put in the thin back at regular intervals. The iron was put up within about four inches of the highest point of the back. The duty of the iron was to hold the stand solidly together at the top; the shelf answers the same purpose at the lower end.

The stand, when smoothed down, was given a coat of Wheeler's Patent Wood-Filler, which gave it a very fine appearance. When the "filler" was dry and hard, a coat of good furniture varnish was applied, which, as Ellwood said, "gave the whole thing a finishing touch."

Two or three days after being finished, the stand was taken into the house, and was placed in position in the hall. Jessie made it her special business to inform every visitor that called; "that they had a new umbrella stand," and "that Fred and Ellwood made it all themselves," and, "that it was the nicest umbrella-stand that was ever made." She always seemed to forget that her father directed the movements of her brothers.

Fred and Ellwood wanted some kind of a bracket or shelf in their bedroom, on which their books and some other things might be placed, so Mr. Carpenter designed a plain bracket, same as the one shown at Fig. 48, and it was decided to

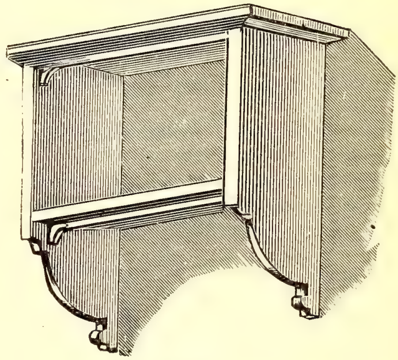


Fig. 48.

make two like it, one for Fred and his brother, and the other for Jessie's sleeping-room.

It was decided to make them of black walnut, so pieces of the following dimensions were obtained for the purpose: Four side-pieces, nine inches wide, seven-eighths thick, and eighteen inches long. Two top shelves, two feet long, ten inches wide, and seven-eighths thick. Two bottom shelves, twenty inches and a quarter long, nine inches wide, and seven-eighths thick. Four bracing pieces, two inches wide, twenty and a quarter inches long, and seven-eighths thick. These lengths and widths were the exact ones, and great care was taken to make the ends as near square as possible, both from their face sides and their edges. Fred smoothed the stuff up with the smoothing-plane very nicely, and his father "laid out" or "marked off" one of the sides same as

shown at Fig. 49, leaving exactly eleven inches space between the underside of the top shelf and the top-side of the bottom one. The shape of the bottom end of the sides is shown at O. When Mr. Carpenter had marked off the shape to suit him, the marked piece was handed over

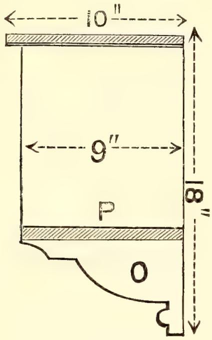


Fig. 49.

to Ellwood to cut out with the scroll saw, with a caution to cut close to the lines and not to feed his saw *too fast*. This caution was quite necessary, as young or inexperienced people apt to "crowd" a saw when they have thick stuff to cut. Ellwood, however, made a good job of the sawing and his father was quite pleased with it.

One of the sides being made to the right shape, and marked over for the bottom shelf, as shown at P, it was laid on the other sides, one by one, and a lead pencil run round the curve and mouldings, which left a line on the uncut pieces, as a guide for the sawyer to make them all alike in shape. The work of sawing the other three sides fell to the lot of Ellwood, who, by the by, had got to be quite an expert

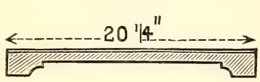


Fig. 50.

in the use of the scroll saw. The next thing Mr. Carpenter did was to mark out one of the bracing pieces to shape, as shown at Fig. 50. When finished, it was handed over to Ellwood to saw, after which operation it was used to mark the other pieces, which were afterwards sawed to shape.

All the stuff was now finished and ready to be put together, so the first thing done was to glue the bracing pieces on to the shelves. On the bottom shelves, they were glued just one inch from the front edge, and being exactly the same length, there was no trouble adjusting the ends. On the upper shelf this matter was a little more difficult to deal with as the shelf was longer and wider than the bottom one, so it was found necessary to keep the bracing piece two inches from the face or front edge, and the ends of it were kept equi-distant from the ends of tne shelf. Mr. Carpenter, after gluing the pieces in place, took a fine brad-awl and made a few holes in the pieces on their under sides, and drove brads in them, taking care that the brads were not too long, as it would have spoiled the work if the points of the nails showed through on the top of the shelves.

The other work was then put together, care being taken that the bottom shelves were glued and bradded on the lines, as shown at P, Fig. 49. A few fine screws were used to fasten the top shelves, but brads only were used in fastening the sides to the lower shelves and to the bracing pieces.

Mr. Carpenter did not put any backs to these brackets because he thought the walls against which they were hung would form all the back required. If the inside back edges had been rabated out about half an inch, and the bottom shelves left half an inch narrower, a back one-half inch thick could have been bradded in the rabats and to the shelves, then the brackets would have been as strong as they were neat and useful.

The work was now, in a measure, completed, with the exception of smoothing and oiling; this part of the work was given over to Ellwood, who sand-papered both brackets with very fine sand-paper, taking care all the time that he never rubbed the paper across the grain, as he was aware that by so doing he would leave scratches and marks that would

be "eyesores" as long as the brackets lasted. When the work was sufficiently smoothed, he applied a light coat of raw linseed oil with a clean linen rag; this darkened the wood and made it look much richer. This operation being over, and the work, so far, being finished to the satisfaction of all concerned, it was necessary to devise some means to attach the brackets to the wall. This was done by procuring two heavy picture-frame rings and fastening them in the brackets through the top shelf, as seen at Fig. 51, where a front elevation of

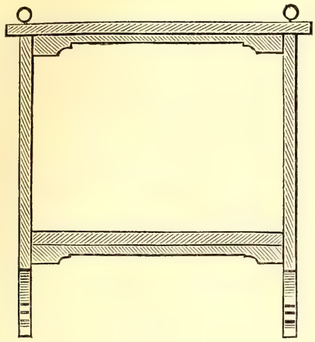


Fig. 51.

the completed work is shown. The rings are on the top in a line with the side pieces.

Picture-frame nails were used to fasten the brackets to the wall, though Mr. Carpenter had some trouble in finding solid places to put them.

The boys left their bracket just as it came from their workshop, but Jessie hung a pair of curtains in front of her's, which gave it a very nice appearance, more particularly as she used the upper shelf for holding a few choice pieces of bric-a-brac, and the lower shelf for books, etc.

"Well, boys," said Mr. Carpenter, after the brackets were hung in their places, "you have done exceedingly well, and if I can judge rightly, I may say that you are now able to do almost any kind of simple amateur woodwork."

Care of Kid Boots.

A writer in the *English Mechanic* says: Sometime ago I found that my tin of harness composition emptied rather too fast. On inquiry, I found that "Mary" had used it for months on "missus'" boots. So I began to investigate and found the boots (two years old) to be in a beautiful condition; I also found that Mary had applied a little regularly, taking care to polish with a soft cloth, and that it was very successful. I make my own blacking. 2 oz. best white wax, ½ oz. prussian blue, 1½ oz. ivory black, ¼ pint spirits turpentine, 1 tablespoonful spirits wine. Melt the wax in earthenware vessel over a slow fire, then add the blue and black, taking care to put in the black by littles at first, or it will boil over; when cool add the spirits. Stir it well from first to last.

Bleaching Ivory for Cutlery Purposes.

Mr. A. H. Mason, in discussing the properties of peroxide of hydrogen before the Liverpool Chemists' Association, said: "It is used in Sheffield to bleach the inferior ivory for knife-handles. The liquid is supplied by an ivory dealer in London, and consists of an aqueous solution of peroxide of hydrogen, of which it contains 2·9 per cent. of rather crude H^2 O^2. The mode of procedure is as follows: Place, say, two quarts of the liquid in a stone pot, adding four ounces liquid ammon. fort. 880°, immerse the handles, and put over a common shop-stove for 24 to 36 hours. The handles are then taken out and gradually dried in the air, not too quickly, or they would split. The deep color of the ivory is removed, and a beautiful pearly white ivory results when polished.

Correspondence.

A Beautiful Wood-Thrush Nest.

Ed. Young Scientist—I was informed by a friend of mine one evening last summer (1880) that he knew where a cuckoo nest was; being anxious to obtain a cuckoo egg, I went next morning to the place designated, but instead of seeing a rude cuckoo nest, I saw a beautiful wood-thrush (*Turdus Mustelinus*) nest which was situated in the fork of a pine tree. It was built inwardly the same as any other wood-thrush nest, but the outside was elaborately draped with long strips of thin paper, some of them measuring a foot or more. As the bird had deserted it, I obtained the nest and two eggs which are at present in my collection.

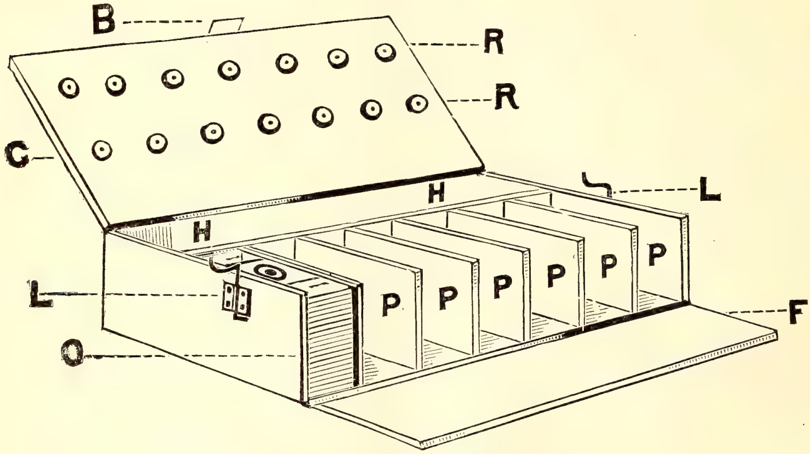
ALEXANDER G. GIBBS.

A Cheap Cabinet for Wooden Slides.

IT is the object of this cabinet to do away with the "elastic band" arrangement, and its inconveniences, and to afford a receptacle for uncovered wooden slides which shall at once exclude all dust from the objects, admit of quick reference, and be cheap and easy of construction.

The slides lie flat as at O, and the objects in each compartment may be indexed by labels pasted on (H H). If the compartments are kept filled with slides (both with and without objects) when the cabinet is shut up, the rubber springs (R R) pressing on the slides will squeeze them together, and so exclude all dust.

A very neat appearance is given to the



A CHEAP CABINET FOR WOODEN SLIDES.

cabinet by covering it with morocco paper.

It consists of a segar box of convenient size, with front (F) and cover (C) hinged. A cloth hinge answers every purpose.

The interior is divided into compartments 3 1-16 × 1 1-6 in. by several partitions, (P P P P P) which are held in place by a piece of wood (H H), fastened in the back of the box and having sawed in it several slots into which the several partitions are glued.

On the cover are attached disks of rubber (R R) (made by cutting small rubber stoppers into four parts) or rubber rings (made from tubing)—the latter being put on upright. There should be two to each compartment; the upper or front ones about ¾ inch from the front edge, and the lower, or back ones, about 1½ in. from them. When the box is closed, the front (F) is kept in place by an overlapping piece of metal, (B) screwed on to the top, and the cover is pressed down by means of two stout wire catches (L L).

FRED. LE ROY SARGENT.

May, 1881.

Back Numbers and Volumes.

WE can supply any back number or volume of the YOUNG SCIENTIST. One number (August, 1880) is now out of print, but, as the pages were electrotyed, we can easily reproduce them and will do so as soon we have taken stock of all the other numbers and know precisely what ones will probably be needed. The prices are: single numbers, six cents; volumes in loose numbers, fifty cents; volumes, neatly bound in cloth, with gilt titles on the back, $1.00 each. At these prices the volumes and numbers will be sent free to those ordering them. Postage stamps of small denomination will be received at full value for sums less than $1.00.

Our New Catalogue of Books.

WE have just issued a new catalogue containing a description of our most recent publications. A copy will be sent free to any one who requests it.

Cheap and Useful.

WE find that we have on hand a few copies of the *first* edition of the "Amateur's Handbook of Practical Information for the Laboratory and the Workshop." It contains quite a large number of useful recipes and directions for mechanical processes. In order to close out the remainder of this edition, we will send a copy to any address, on receipt of seven cents in postage stamps.

BOOK NOTICES.

Celestial Objects for Common Telescopes. By the Rev. T. W. Webb, M.A., F.R.A.S. Fourth Edition, Revised and Greatly Enlarged. New York: The Industrial Publication Company. 1881.

This work is too well known to require a lengthened notice at our hands. It has been out of print for some time, and the eagerness with which stray copies of the third edition have been picked up, shows the value of the book to all amateur astronomers. The edition before us is in reality the *English* edition, merely bearing the imprint of the Industrial Publication Company. It forms a substantial volume of 493 pages, with the well-known Map of the Moon, and very highly executed illustrations of many specially interesting points. No person that takes enough interest in astronomy to point even a common opera-glass at the heavens can afford to be without it.

Lowey's First Steps in Chemistry: A Series of one hundred and fifty select and amusing Chemical Experiments, Free from Danger. Frederick Lowey, Brooklyn, N. Y.

This is a little hand-book designed to accompany the chemical cabinets put up by Mr. Lowey. It describes a great many pleasing experiments which are easily performed. Some of the experiments (98, for example) will hardly succeed when carried out precisely in the manner indicated, but the majority of the directions are reliable. It would have been well, however, if the old methods, which are given in some cases for determining quantities, had been replaced by something more definite and easily understood. A "penny worth" is a very indefinite quantity, and besides that, we have no coin which can be accurately called a "penny." So in the case of "spirits of wine." A country druggist will probably say he has none; he knows it as alcohol of about 90 per cent. And it is useless to tell the reader to use pyro-acetic spirit as a cheap substitute, because it is not usually found in our drug-stores, although a common article in England. But notwithstanding these defects the book will afford a great deal of instructive amusement to those who attempt to follow its directions.

Practical Hints.

Ink for the Hectograph.—Anilin color, 5·0; alcohol, 5·0; mucilage of acacia, 5·0; water, 35·0. Dissolve by means of heat, and strain through flannel or cotton.

Cement for Bisulphide Prisms.—A good cement to fasten the sides of bisulphide of carbon prisms is made of a mixture of good glue and concentrated glycerine, the composition used for making rollers in printing presses.

Labels.—Paper labels, attached in the usual manner, and, when dry, varnished over with two or three coats of good copal varnish, will be found to resist almost all chemicals except liquor potassæ and liquor sodæ.

To Make Tents and Awnings Waterproof. Tents made of very light canvas will become perfectly waterproof, as well as proof against mildew, if first soaked in a strong solution of soap, and afterwards passed through a liquid made by dissolving equal parts of alum and sulphate of copper in five times their united weight of water.

Stains of Tar.—It is said that tar may be instantaneously removed from hand and fingers by rubbing with the outside of fresh orange or lemon peel, and wiping dry immediately. It is astonishing what a small piece will clean. The volatile oils in the skins dissolve the tar, so that it can be wiped off.

Fair of the American Institute.—The semi-centennial fair of the American Institute is held this year in the Rink, on Third Avenue, near Sixty-third Street. These fairs are amongst the most important educational agents we have. They present to the young a continuous series of object lessons of the most instructive kind, and should command the attention of all parents and teachers.

Coppering and Bronzing Zinc.—The following recipes for coppering and bronzing zinc are said to produce quite beautiful results: Prepare a solution of fifteen parts of blue vitriol and one of nineteen parts of cyanide of potassium, then mix both solutions together. Incorporate this liquid well with one hundred and sixty parts of pipe-clay, and rub the semi-fluid mass obtained by means of a linen rag, on the previously cleaned object. For bronzing, take fifteen parts of verdigris, nineteen of cream of tartar, and thirty parts of crystallized soda, reduce them to powder, and dissolve them in the necessary amount of water. Mix this liquid together with

one hundred and sixty parts of pipe-clay, and proceed as above directed. Another process is as follows: Take fifteen grammes of blue vitriol, twenty of calcined soda, mix them well with thirty-two cubic centimetres of glycerine, and mix the paste obtained with eighty grammes of pipe-clay. It is then ready to be applied as before stated.

The Obelisk in the Central Park, New York, weighs two hundred tons, or is equivalent to the weight of about eight hundred and twenty millions of Esterbrook's Ladies' Pens.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business letters or cards they cannot be used.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

To exchange, Hugh Miller,s "Cruise of the Betsey," and "The Old Red Sandstone," cloth bound geological books, for lathe, hammock, or "Gray's Manual of Botany." Gus. C. Spaeth, Mt. Carmel, Ills.

F. F. F., Lock Box 83, St. Johnsbury, Vermont, would like to exchange or correspond with persons interested in mineralogy, Oology, philatology, Indian relics, books, entomology, numis matology, etc.

Wanted, a good printing press and type; state what is wanted in exchange. H. A. Kinney, Hamlin, Brown Co., Kansas.

I have a printing press and outfit (cost $15) to exchange for books, microscope, tent, watch, or offers. Henry E. Jacobs, 59 Harvard Street, Boston, Mass.

I have Vols. 2 and 3 of "Nests and Eggs of American Birds," to exchange for Vol. I of Young Scientist, or offers. N. B. Stone, Lock Box 9, Putnam, Conn.

Wanted, a printing outfit or offers, in exchange for baritone cornet, air gun, and other things, a list of which will be furnished upon application. E. S. Nixon, Jr., Box 345, Chattanooga, Tenn.

To exchange, minerals, ores, shells, papers, magazines, books, coins, stamps, for stamps, coins, minerals, stylographic pen, telephone, etc. A. M. Beveridge, P. O. Box 854, Appleton, Wis.

Will exchange minerals for other minerals; state what specimens you desire. E. A. Refsnyder, Phœnixville, Chester Co., Pa.

Wanted, a good powerful second-hand microscope; forward engraving of instrument, stating price, or what is wanted in exchange. L. D. Snook, Barrington, Yates Co., N. Y.

Wanted, botanical specimens of Western, West Coast, and Southern ferns, in exchange for Northern species; lists exchanged. H. N. Johnson, Coeymans, N. Y.

Wanted, copy of "Snowball's Elementary Natural Philosophy." M. B Tausy, Harrisburg, Pa.

A new 2x4 engine, worth $60, for a first-class bicycle; also a watch, revolver, and gas stove, for a 6x9 printing press, type, or offers. Geo. L. Lamson, La Fargeville, N. Y.

To exchange, specimens in botany, oology, etc., for those in other localities; botanical correspondents desired. Arthur Fairbanks, St. Johnsbury, Vt.

To exchange, for other books on scientific and industrial subjects, "Moore's Universal Assistant," "The Young Mechanic;" both quite new. Fred. Whitehead, Box 55, St. Augustine, Fla.

A German microscope, with 3 objectives and 5 eye-pieces, condensing lens, etc., resolving Pleurosigma angulatum, will be exchanged for a first-class spectroscope. Clarence L. Speyers, 50 West 17th St., New York.

I have a fine concert harmonica, 20 notes, with case, but little used, that I will exchange for Vol. 3, of the Young Scientist. Charlie O. Wells, Hatfield, Mass.

To exchange, birds' eggs and minerals, for minerals, ores, and curiosities. H. G. Emery, 51 Spencer St., Albany, N. Y.

To exchange, for engine or offers, a pair of Bliss Telephones and 200 feet of copper wire. J. W. Grant, 402 Broad St., Newark, N. J.

To exchange, a 2½ octave chromatic xylophone for microscope, microscopical apparatus, scientific books, or offers. J. E. Moore, Box 81, Newcastle, Ind.

To exchange for offers; a small lot of microscopic mounting apparatus. List on application to J. N. B,, Box 1468, N. Y.

To exchange, books and Young Scientist, and trinkets, for other books, revolver, or stylographic pen. Frank Bicknell, Humboldt, Iowa.

Ancient petrified grain, Indian pottery, birds eggs, papers, magazines, Confederate money, fossils, minerals, to exchange for arrow-heads, Indian relics, Confederate, Continental, and other paper money. Fred T. Brinkerhoff, Box 347, Neenah, Wis.

Minerals, tricks, copper coins, book on pigeons and rabbits, Wilson School History, for book on experiments, or specimens, minerals, stamps or coins. P. R. Bradley, Box 305, Dunkirk, N. Y.

Wanted, a second-hand screw cutting foot lathe, must be in good condition; state what is wanted in exchange, also size and make of lathe. G. A. Clark, Castalia, Iowa.

To exchange, minerals, shells, fossil shells, birds eggs, etc., for minerals, shells, fossils, stuffed birds, birds eggs, and books. U. S. Grant, Des Moines, Iowa.

Wanted, botanical correspondents for the coming season, also amateur correspondents in chemistry. L, Box 70, East Templeton, Wov. Co., Mass.

Wanted, to exchange a well-equipped job printing outfit, for books or offers. Frank A. Niblack, Rockport, Ind.

Will exchange for Vol. 2 of the Young Scientist, instructive books bound in cloth to the value of $1.50. Chas. H. Williamson, 293 Eckford St., Greenpoint, Brooklyn, N. Y.

I have a new Munsen's battery, large size, which I wish to exchange for a good revolver or offers. Robt. T. Boyle, 351 West 83d St., New York.

Hair of American deer to exchange for diatoms, foraminifera, or other material. W. H. Osborn, Chardon, Ohio.

To exchange, full instruction in short-hand writing, and birds eggs, for birds eggs, postage stamps, or offers. M. F. E., 51 Spencer St., Albany, N. Y.

Wanted, specimens in geology, entomology, oology, etc., for those in other localities, also coins and a charm microscope (magnifies 1,000 times) for one having a different view. J. H. Jones, Frankfort, N. Y.

"History of Our Country," by Lossing, in six parts, price $15, to exchange for printing press or offers. Frank Chandler, Waverley, Mass.

THE Young · Scientist.

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

INDUSTRIAL PUBLICATI

A PRACTICAL JOURNAL OF

HOME ARTS.

VOL. IV. NEW YORK, OCTOBER, 1881. No. 10.

Sizes of Books.

OUR young readers have doubtless been often puzzled to know what was meant by the terms 12 mo., 8 vo., etc., used in describing the sizes of books, and as we have frequently been asked to explain these terms, we will try and make the subject plain.

When a publisher undertakes to put the intellectual labors of an author into the form of a book, one of the first things to be decided is the size of the page, and this generally depends upon the amount of reading matter in the work, though sometimes it is governed by the size of the illustrations or engravings, if there are any. At first sight this would look as if the book were made for the engravings, and not the engravings for the book; but if the reader will think again he will see that in order to show clearly what is intended to be illustrated, the engravings must have a certain size. If too small, some of the important parts would be visible only by the use of a magnifier.

The price at which the book is to be sold has also an important influence on the size. If the book is to be a handsome holiday volume, the size of the page will probably be larger than if the work is intended for ordinary buyers. This is particularly the case in regard to scientific and industrial books, where great economy is often desirable.

Having decided upon the size that the page ought to be, the next questions are as to the size of paper and the number of times it shall be folded to give the desired page. At first all paper was of the same size, and a sheet when folded once gave four pages, which were of the size known as *folio*. Folded again, there were eight pages, and the size was called *quarto*. But eight pages make four leaves; hence *quarto* (or 4to.) expresses the number of *leaves* to the sheet, and not the number of pages. Folded again, the sheet gives us eight leaves or sixteen pages, and is called an octavo, which, when written, is

often contracted to 8vo, or 8°, and is sometimes, though barbarously, pronounced eight-vo. Hence we see that by simply folding over and over again we get the following series. A sheet folded

Once	gives	two	leaves	called	Folio.
Twice	"	four	"	"	Quarto.
Thrice	"	eight	"	"	Octavo.
Four times	"	sixteen	"	"	Sexto-decimo.
Five times	"	thirty-two	"	"	Trigesimo-secundo.

If our readers will take a sheet of any kind of paper, and cut it to the size of 24 by 19 inches, and will fold it over and over again, they will get a clearer idea of this matter than by any amount of description. They will also find that when folded three times the page will be the same size as that of the YOUNG SCIENTIST, and they will therefore conclude, and rightly, that the latter is an octavo.

An ordinary sheet of paper may, however, be folded otherwise than by a constant process of *halving*, for that is what the system of folding that we have just described amounts to. Thus, instead of halving the sheet, we may fold it twice so as to divide it into *three* parts instead of two, as when we folded it once. When these are folded on each other they form a long three-ply strip, and when this strip is folded twice, so as to divide it into four parts we have twelve leaves or twenty-four pages, and this is called a *duodecimo* (generally written 12mo.) In a similar way the sheet may be folded into eighteen and other numbers of leaves, it being always understood that the number refers to the *leaves* and not the pages. This is the point at which most people are apt to get befogged; there are three things which the terms might express, viz.: the number of *folds*, the number of *leaves*, or the number of *pages*. It is the number of of leaves that is meant.

But since paper is found in sheets of different sizes, the preceding system tells us merely the number of leaves to the sheet, and gives no definite clue to the size of the work. Hence we actually find some 12mo. books which are as large as some 8vo. ones. As a further guide to size, therefore, we have the size of the paper sometimes given, and we find such expressions as Royal Octavo, Demy Octavo, Crown Octavo, etc. But even in the most elaborate form this system does not meet the requirements of the case, and various schemes have been devised for the purpose of giving exactness to the terms used. One of the worst is that fixed upon by the Associated Librarians of Great Britain, who have ignored everything but the foot rule, and have adopted the following scale of measurements, the inferior limit of each size being the superior limit of the size below it:

NAME.	CONTRACTED TO.		SIZE	
Large folio	la. f°	over	18	inches
Folio	f°	below	18	"
Small folio	sm. f°	"	13	"
Large octavo	la. 8°	"	11	"
Octavo	8°	"	9	"
Small octavo	sm. 8°	"	8	"
Duodecimo	12°	"	8	"
Decimo-octavo	18°	is	6	"
Minimo	m°	below	6	"
Large quarto	la. 4°	"	15	"
Quarto	4°	"	11	"
Small quarto	sm. 4°	"	8	"

To designate unusual sizes the additional terms *square* (sq.), *narrow* (na.), and *oblong* (ob.) are to be used. That it will be difficult to devise a perfect system we fully acknowledge, but any system, to prove acceptable, must do more than tell us the number of inches to which the binder's apprentice has cut down the volume. The size of the printed page and of the type are of quite as much importance to readers and buyers as the mere width of the shelving, which must be used to hold the book.

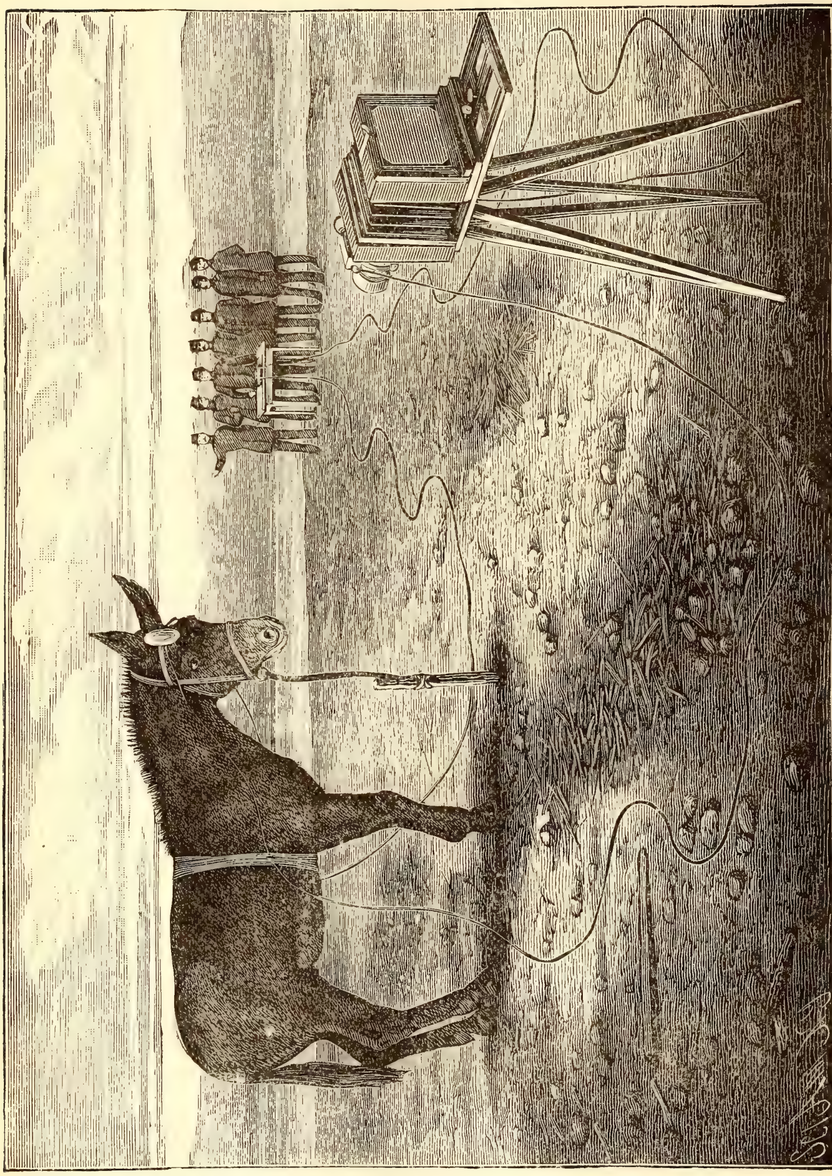
—In many cases mineral oils are not to be recommended as lubricants, since they attack any India rubber with which they may happen to come in contact.

Burnished Gilding on Glass.

IN the first place, it is necessary to make a size for fixing the gold leaf to the glass, which is made in the following manner: Obtain some best isinglass, and place as much in a teacup as will cover a shilling piece; then pour half a cupful of boiling water upon it; then add as much spirits of wine as water in the cup, strain the whole through a piece of fine cambric or a silk handnerchief; when cold it is ready for use. Whatever writing or ornament you require to put on the glass must be first drawn or set on paper the exact size of the glass. When you have made your design or letters on the paper (with a lead pencil) the size you require, prick the outlines through with a fine needle, placing the paper on a piece of smooth, soft wood, so that it does not blunt the point of the needle (and make the holes unnecessarily large). When this is done, clean your glass thoroughly; then place your design, reversed, to back of the side you mean gilding, fixing it with a little gum at each corner; then place your glass in a slanting position. Take a large size swan-quill pencil, and flow the size on where you require the writing or ornaments: then commence gilding, putting your gold out on a cushion, and cutting it the proper sizes, or of such sizes as you can easily take up with the tip. Let each joint overlap the other, gilding the whole space where the writing, etc., is to be, having the gold about one-fourth inch wider at the top and bottom of the letters. When you have completed the gilding so far, the glass should be set upright to drain the surplus size off, and near a fire, or in a warm place, to dry. When dry, which you will ascertain by its assuming a burnished appearance, take a piece of cotton wool and rub it over very softly. By this means you will remove all the loose pieces of gold, and increase the burnish of the gold. If there are any faulty places in the gilding, flow a little size on the place, and put a piece of gold over it, rubbing the place so repaired gently with cotton wool, when dry. Then use a large flat camel-hair brush, and size the whole of the gold over lightly, so as not to disturb the gold. When this is dry, pour some hot water over the gilding, which enhances the brilliancy of the gold very considerably. When dry, which it will do in a very few minutes, size it over softly to prevent the paint from percolating the gold. Having completed your gilding, you take your design off the back of the glass (which enabled you to see how far to gild), and place it on the gilded side, reversed, taking care to fix it securely, so that it shall not move, while you pounce it over with a white pounce softly; then raise the paper off the glass carefully, so as not to brush the pounce marks away. You will then have the outlines of your design left on the gold. Take a sable writing pencil, and fill up the outlines with Brunswick black of as thick consistency as you can work it with the pencil; when this process is quite hard, take a wet sponge, and gently wash all surplus gold off clean. Then take a small straight-edge and a chisel, and cut the top and bottom of the letters, etc., quite straight and true. This process is called trimming, by which means you obtain a sharpness of outline that you could not obtain with the pencil, however expert you may be. You may then shade in what color you think proper, and paint whatever color background over all to suit your fancy.—*Design and Work.*

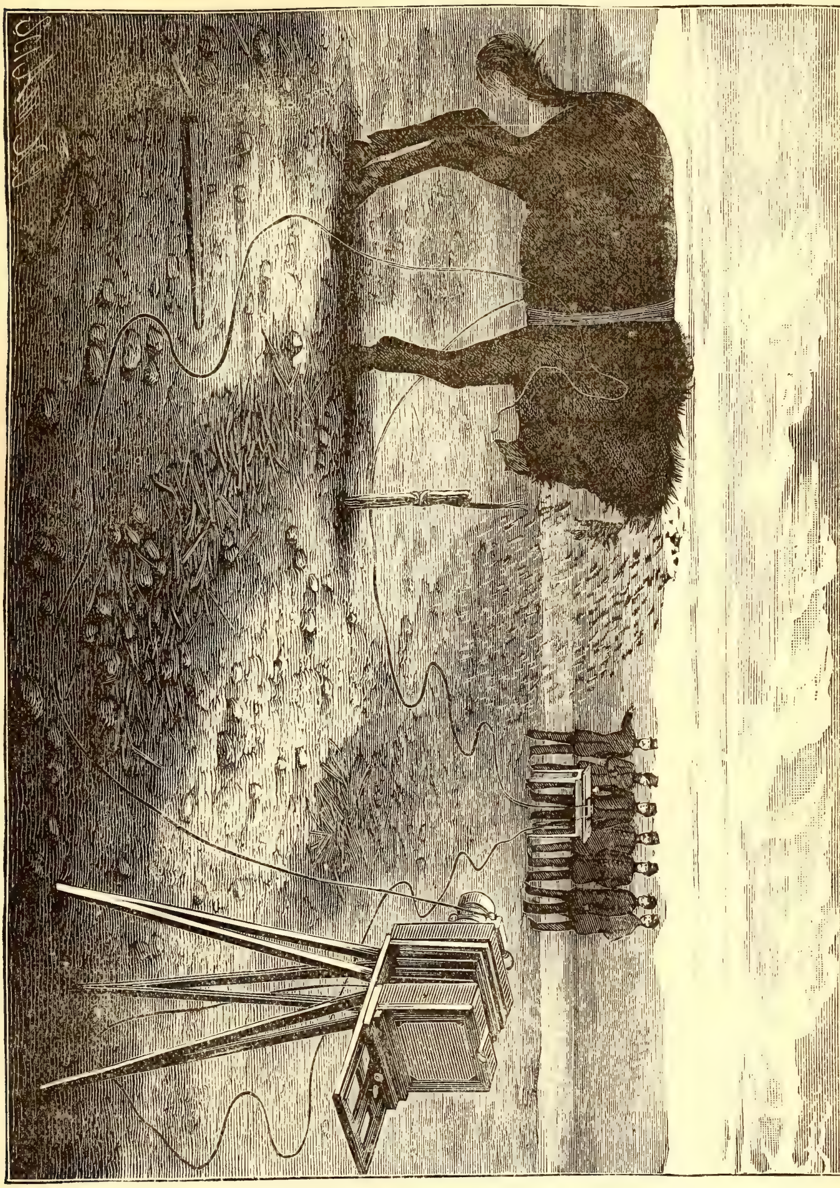
Instantaneous Photography.

WHEN objects are in rapid motion it is very difficult to observe them distinctly. This does not arise from the fact that the eye fails to get an impression of the object, because it can be proved that objects may be distinctly seen even when presented to the eye for less than the one-thousandth part of a second. But owing to what is known as *the persistence of vision*, objects in motion give rise to a series of images on the retina, and as these images overlap, as it were, the result is a confused blur. The best illustration of this is seen in a common experiment well known to every boy and girl. Take a stick with the end on fire and glowing, and move it slowly either back



INSTANTANEOUS PHOTOGRAPHY.

Fig. 1.—BEFORE THE EXPLOSION.



INSTANTANEOUS PHOTOGRAPHY.

Fig. 2.—AFTER THE EXPLOSION.

and forward in a straight line, or whirl it round in a circle. If the motion be sufficiently slow the fiery point will be visible at every portion of its path, but if it completes the circle or returns along the straight line in less than the eighth part of a second, it will appear as a line of light in the one case, and a circle in the other. The cause of this is that the eye again obtains a view of the burning point at the commencement of the line or circle before the image produced by its first appearance there has faded away. It is this fact which renders it so difficult to obtain a clear view of objects in motion. Take the case of trotting horses, for example. Hitherto it has been impossible to analyze their motions, and the most extraordinary theories have been propounded in regard to the matter. Fortunately, however, photography has come to our aid, and a few years since, in San Francisco, Watron took a series of photographs which were so instantaneous that the positions of the limbs at different points of the step were quite clear and distinct. This was due to the fact that the plates used required such a short time for exposure that the limbs did not move through an appreciable space during the interval. More recently, M. Maybridge, of Paris, has taken photographs so rapidly that he has made six pictures during a clown's leap, each picture showing the acrobat in a different position. The time required to take one of these photographs has been proved by M. Marbridge to be less than the 1-100th part of a second.

One of the most remarkable photographs that has come under our observation is that taken under the direction of Gen. Henry L. Abbott, U.S.A., in charge of the Engineer School of Application, Willet's Point, N. Y. It became necessary, one day, at Willet's Point to destroy a worthless mule, and on the 6th of last June the subject was made the occasion of giving useful instruction to the military class there stationed. The mule was placed in proper position before a photo camera and duly focussed. Upon the animal's forehead a cotton bag was tied containing six ounces of dynamite. The slide of the camera was supported by a fuse; the camera fuse and the dynamite on the mule's head being connected in the same electrical circuit, as shown by the wires in our engraving. On pressing the key so as to send the electricity through the wires, both the fuse and the dynamite were simultaneously fired; the camera slide and the head of the animal fell nearly together. The photo sensitive plate was impressed with a picture of the headless creature, still standing, before its body had time to fall.

Fig. 1 of our illustrations, for which we are indebted to the courtesy of the *Scientific American*, shows the animal, camera and electrical wires in position for firing. Fig. 2 shows the appearance of the animal after the explosion, as taken on the photo plate. Here it will be observed that the head has been shattered and blown to one side, hanging by the merest shred of skin. The shock has, however, been transmitted to the entire muscular system of the animal, as will be seen by the appearance of the tail and the hind limbs. One of the most singular circumstances, however, is the fact that the fragment of the halter, by which the mule was fastened to the stake, has not had time to fall, but remains standing as if it were a stiff rod.

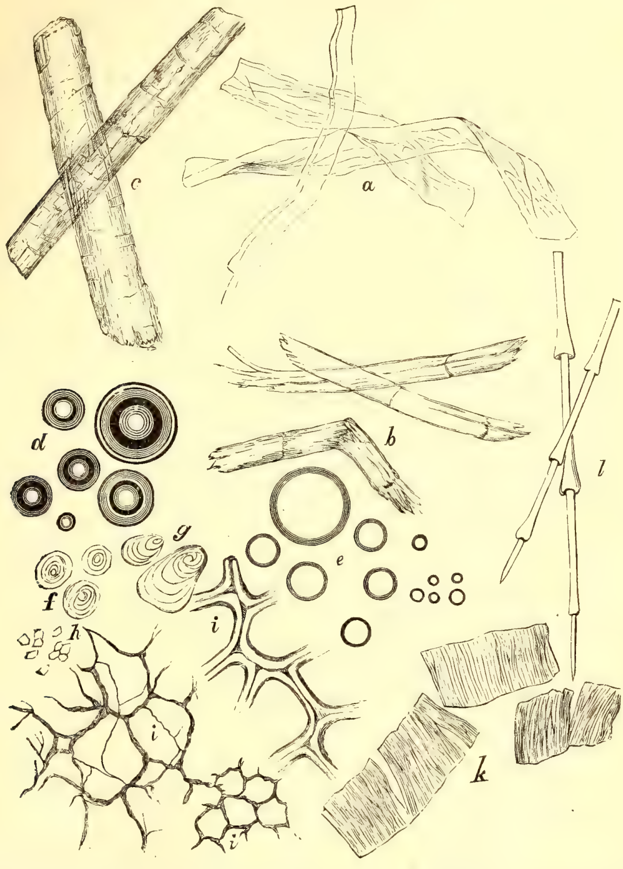
Rubber-Headed Tacks.

A New England firm have patented and are manufacturing a rubber-headed tack whose uses are multifarious. As an insulator for sewing machines they are largely used by the leading manufacturers, and are easily and quickly applied. For household uses they are placed in the backs of chairs to prevent damage to walls; in the ends and sides of door steps; in rabbets of large folding doors; on lids of pianos; in rabbets of rattling window frames, and, in fact, anywhere to overcome the nuisance of rattling. Car manufacturers use them to deaden noise and avoid abrasion of polished surfaces. Carriage manufacturers apply them to stop the rattling of window frames and doors, and for glass frames to drop upon on the inside of doors. Book manufacturers place them on the corners of large books to protect the binding. In schools, slate frames and rattling desk lids demand them. On billiard cues they are used, and obviate the use of chalk. Indeed, there is hardly any limit to which this useful article may not be applied.

Microscopical Mistakes.

ONE of the most common causes of mistakes on the part of young microscopists is the presence of foreign substances in the objects under examination. It is true that these things cause trouble chiefly to beginners with the microscope, but sometimes even experienced hands are led astray. Beale, in his book, "How to Work with the Microscope," relates some curious and astonishing instances of this.

There are certain things which are so universally present that they are liable to make their appearance in spite of the greatest care. Chief amongst these are air bubbles, which present themselves as great round, black objects, which are sure to attract the attention of the young microscopist to the exclusion of everything else. Older observers pay no attention to them. Then the lint from the cloths with which the slides are wiped; particles of dust from the air; fragments of wool from carpets and clothes; dust and splinters from cork and wood; bits of hair, feathers, leaves, etc., etc., are all liable to light on our work. In the accompanying engraving we give the appearence of a few of these things, and



FOREIGN SUBSTANCES LIABLE TO BE FOUND IN MICROSCOPIC PREPARATIONS.

a. Cotton fibres. *b.* Flax fibres. *c.* Hairs. *d.* Air bubbles. *e.* Oil globules. *f.* Wheat starch. *g.* Potato starch, *h.* Rice starch granules. *i, i, i.* Vegetable tissue. *k.* Muscular fibres. *l.* Feathers.

would advize our readers to study them closely, so as to familiarize themselves with the way they look. A better plan, however, is to take the actual objects themselves, and examine them carefully under the microscope. Bubbles, in particular, deserve very careful study. Procure a little gum water and a few phials. In one shake the pure gum water up with air, place a little on a slide, and study the air bubbles. In another put some gum water and a little oil colored with alkanet root; shake them up, put a little on a slide, and study the globules of oil in water. Fill a third half full of oil, add a little gum water, shake the two together, and study the globules of water in oil. A course of study of this kind will prove of inestimable value.

Something New in Entomology.

LAST Sunday, as Mr. Jones was returning from church with his family, he discovered a new and singular-looking bug on his front door-step. As he was something of a scientist, he was pleased with the new specimen, and, forming his pocket-handkerchief into a sort of cage, he pounced down on it and succeeded in capturing it.

"Bring the microscope, children," he called, "and tell your ma to hurry; I want her to look at it; I'm sure it belongs to the Hemiptera class, and is a new specimen. Here, Charlie, put your eye to the ocular side and tell me what you see."

"Oh, pa, ain't it splendid? It's got four wings, eight eyes, and, oh, my! ain't it a-sparkling though? Red and green and yellow, and—oh, it's getting away, ain't it pa?"

"Then it isn't dead!" cried Mr. Jones, in ecstacy; "I wasn't quite sure whether it moved or not. Let me look! Yes, it's a terrestrial, I think, after all; it belongs to the genus Pentoma—the antennæ have that peculiar flexible look; and yet, now that I look again, the eyes seem to indicate that it is a phytocoris, in which case it will be very destructive to your ma's plants, and we must kill it at once. I'll ask Professor Sill. It will be in any case, a valuable addition to science. Maria, where's the chloroform?"

"Up on the clock shelf; what are you going to do with it?" asked Mrs. Jones, who had been giving her undivided attention to the baby.

"Kill this bug as soon as you have examined it," answered Mr. Jones, in a lofty voice. "I shall present it to the scientific association—"

"Well, I guess not, Mr Jones," broke in his wife, who was looking with much interest at the new specimen. "I paid $2 for that bug last week to wear on my new bonnet, and I must have dropped it off when I came in. It belongs to the genus millineræ, and couldn't be any deader if it had been baked for a century. Science will have to get along without it, Jones; it's already classified." Poor Jones.—*Ex.*

Marvels of Pond Life—II.

THE winter months are on the whole less favorable to the collection of microscopic objects from ponds and streams than the warmer portions of the year; but the difference is rather in abundance than in variety, and with a very moderate amount of trouble, representatives of the principal classes can always be obtained.

On a clear January morning, when the air was keen, but no ice had yet skinned over the surface of the water, a visit to some small ponds in an open field not far from Kentish Town provided entertainment for several days. The ponds were selected from their open airy situation, the general clearness of their water, and the abundance of vegetation with which they were adorned. Near the margin confervæ abounded, their tangled masses of hair-like filaments often matted together, almost with the closeness of a felted texture. At intervals, minute bubbles of air, with occasionally a few of greater size, indicated that the complex processes of vegetable life were actively going on, that the tiny plants were decomposing carbonic acid, dexterously combining the carbon—which we are most familiar with in the black opaque form of

charcoal—to form the substance of their delicate translucent tissues, and sending forth the oxygen as their contribution to the purification of the adjacent water, and the renovation of our atmospheric air. This was a good sign, for healthy vegetation is favorable to many of the most interesting forms of infusorial life. Accordingly the end of a walking-stick was inserted among the green threads, and a skein of them drawn up, dank, dripping, and clinging together in a pasty-looking mass. To hold up a morsel of this mass, and tell some one not in the secrets of pond-lore that its dripping threads were objects of beauty, surpassing human productions, in brilliant color and elegant form, would provoke laughter, and suggest the notion that you were poking fun at them, when you poked out your stick with the slimy treasure at its end. But let us put the green stuff into a bottle, with some water from its native haunt, cork it up tight, and carry it away for quiet examination under the microscope at home.

Here we are with the apparatus ready. We have transferred a few threads of the conferva from the bottle to the *live box*, spreading out the fine fibres with a needle, and adding a drop of water. The cover is then gently pressed down, and the whole placed on the stage of the microscope, to be examined with a power of about sixty. A light is thrown somewhat obliquely by the mirror through the object, the focus adjusted, and a beautiful sight rewards the pains. Our mass of conferva turns out to contain one of the most elegant species. Fine hair-like tubes of an organic material, as transparent as glass, are divided by partitions of the same substance into cylindrical cells, through which a slender ribbon of emerald green, spangled at intervals with small round expansions, is spirally wound. We shall call it the Spiral Conferva, its scientific name being *Spirogyra quinina*. Some other species, though less elegantly adorned, make a pleasing variety in the microscopic scene; and appended to some of the threads is a group of small crystal bells, which jerk up and down upon spirally twisted stalks. These are the "Bell Flower Animalcules" of old observers, the *Vorticellæ*, or little Vortex-makers of the present day. Other small creatures flit about about with lively motions, and among them we observe a number of green spindles that continually change their shape, while an odd-looking thing crawls about, after the manner of certain caterpillars, by bringing his head and tail together, shoving himself on a step, and then repeating the process, and making another move. He has a kind of snout, behind which are two little red eyes, and something like a pig-tail sticks out behind. This is the Common Wheel-bearer, *Rotifer vulgaris*, a favorite object with microscopists, old and young, and capable, as we shall see, of doing something more interesting than taking the crawl we have described.

A higher power, say one or two hundred, may be conveniently applied to bring out the details of the inhabitants of our live box more completely; but if the glasses are good, a linear magnification of sixty will show a great deal, with the advantage of a large field, and less trouble in follow- the moving objects of our search.

Having commenced our microscopic proceedings by obtaining some Euglenæ, Vorticellæ, and a Rotifer, we are in a position to consider the chief characteristics of three great divisions of infusoria, which will often engage our attention.

It is well known that animalcules and other small forms of being may be found in *infusions* of hay or other vegetable matter, and hence all such and similar objects were called *Infusoria* by early observers. Many groups have been separated from the general mass comprehended under this term, and it is now used in various senses. The authors of the "Micrographic Dictionary" employ it to designate "a class of microscopic *animals* not furnished with either vessels or nerves, but exhibiting internal spherical cavities, motion effected by means of cilia, or variable processes formed of the substance of the body, true legs being absent." The objection to this definition is, that it to some extent represents theories which may not be true. That nerves are absent *all through the class* is an assumption founded merely upon the negative

evidence of their not having been discovered, and the complete absence of "vessels" cannot be affirmed.

In the last edition of "Pritchard's Infusoria," to which some of our ablest naturalists have contributed, after separating two groups, the Desmids and the Diatoms, as belonging to the vegetable world, the remainder of the original family of infusoria are classified as *Phytozoa, Protozoa, Rotifera,* and *Tardigrada.* We shall explain these hard names immediately, first remarking that the Desmids and the Diatoms, concerning whom we do not intend to speak in these pages, are the names of two groups, one distinctly vegetable, while the other, although now generally considered so, were formerly held by many authorities to be in reality animal. The Desmids occur very commonly in fresh water. We have some among our Confervæ. They are most brilliant green, and often take forms of a more angular and crystalline character than are exhibited by higher plants. The Diatoms are still more common, and we see before us in our water-drop some of their simplest representatives in the form of minute boats made of silica (flint) and moved by means still in dispute.

Leaving out the Desmids and Diatoms, we have said that in Pritchard's arrangement the views of those writers are adopted who divide the rest of the infusoria into four groups, distinguished with foreign long-tailed names, which we will translate and expound. First come the *Phytozoa,* under which we recognize our old acquaintance *Zoophyte* turned upside down. *Zoophytes* mean animal-plants, *Phytozoa* mean plant-animals. We shall have by-and-bye to speak of some of the members of this artificial and unsatisfactory group, and postpone to that time a learned disquisition on the difference between animals and plants, a difference observable enough if we compare a hippopotamus with a cabbage, but which "grows small by degrees, and beautifully less," as we contemplate lower forms.

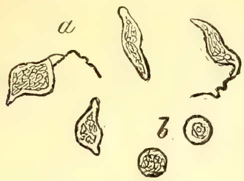
After the *Phytozoa* come the *Protozoa,* or first forms in which animality is distinctly recognized. Under this term are assembled creatures of very various organization, from the extreme simplicity of the *Proteus* or *Amœba,* a little lump of jelly, that moves by thrusting out portions of its body, so as to make a sort of extempore legs, and in which no organs can be discerned,* up to others that are highly developed, like our *Vorticellæ.* This group is evidently provisional, and jumbles together objects that may be widely separated when their true structure and real affinities are discerned.

Following the *Protozoa* come the *Rotifera,* or Wheel-bearers, of which we have obtained an example from our pond, and whose characteristics we shall endeavor to delineate when our specimen is under view; and last in the list we have the *Tardigrada,* "Slow-steppers," or Water Bears, queer little creatures, something like new-born puppies, with a double allowance of imperfect feet. These, though somewhat conected with the rotifers, are considered to belong to a low division of the arachnida (spiders, etc.)

Feeling that we must be merciful with the long-tailed words and explanations of classification, we reserve further matter of this kind for the opportunities that must arise, and direct our attention to living forms by watching the *Euglenæ* which our water-drop contains. We have before us a number of elegant spindle-shaped bodies, somewhat thicker in front than behind, and in what may be called the head there glitters a brilliant red speck, commonly called an *eye-spot,* although, like the eyes of potatoes, it cannot see. Round this eye-spot the tissues are clear, like glass; but the body of the creature is of a rich vegetable green, which shines and glistens as it catches the light. Some swim rapidly with a rollicking motion, while others twist themselves into all manner of shapes. Now the once delicate spindle is oddly contorted, now it swells out in the middle, like a top, and now it rolls itself into a ball. The drawings will afford some idea of these protean changes, but they must be seen before their harlequin character can be thoroughly appreciated. Some of the specimens exhibit delicate lines running lengthwise,

*In some kinds and in some stages of growth this is not strictly true.

and taking a spiral twist as the creature moves about; but in none can any mouth be discerned, and their antics, although energetic and comical, afford no certain



a, motile; and *b*, resting condition of Euglenæ.

indications of either purpose or will. What are they? animals or vegetables? or something betwixt and between?

The first impression of any casual observer would be to declare in favor of their animality; but before this can be settled comes the question, what is an animal, and how does it differ from a vegetable? and upon this the learned do by no means agree. One writer considers the presence of *starch* in any object a proof that it belongs to the dominions of Flora, while another would decide the issue by ascertaining whether it evolves oxygen and absorbs carbon, as most plants do, or whether it evolves carbon and absorbs oxygen, as *decided* animals do. Dr. Carpenter asserts that the distinction between *Protophyta* and *Protozoa* (first or simplest plants and animals), "lies in the nature of their food, and the method of its introduction, for whilst the *Protophyte* obtains the materials of its nutrition from the air and moisture that surround it, and possesses the power of detaching oxygen, hydrogen, carbon and nitrogen from their previous binary combinations, and of uniting them into ternary and quaternary organic compounds (chlorophyll, starch, albumen, etc.), the simplest *Protozoa*, in common with the highest members of the animal kingdom, seems utterly destitute of any such power, makes, so to speak, a stomach for itself in the substance of its body, into which it injects the solid particles that constitute its food, and within which it subjects them to a regular process of digestion."

Unfortunately it is very difficult to apply this simple theory to the dubious objects which lie on the borderland of the animal world, and no other theory that has been propounded appears to meet all cases. Some naturalists do not expect to find a broad line of demarkation between the two great divisions of living things, but others characterize such an idea as "unphilosophical," in spite of which, however, we incline towards it.

Mr. Gosse, whose opinion is entitled to great respect, calls the *Euglenæ* "animals" in his "Evenings with the Microscope," but from the aggregate of recorded observations it seems that they evolve oxygen, are colored with the coloring matter of plants, reproduce their species in a manner analogous to plants, and have in some cases been clearly traced to the vegetable world. It is, however, possible that some *Euglenæ* forms may be animal, and others vegetable, and while their place at nature's table is being decided, they must be content to be called *Phytozoa*, which, as we have before explained, is merely *Zoophyte* turned upside down.

Some authorities have thought their animality proved by the high degree of contractility which their tissues evince. This, however, cannot go for much, as all physiologists admit contractility to belong to the vegetable tissues of the sensitive plant, "Venus' Fly-trap," etc., and a little more or less cannot mark the boundary between two orders of being.

Back Numbers and Volumes.

We can supply any back number or volume of the Young Scientist. One number (August, 1879) is now out of print, but, as the pages were electrotyed, we can easily reproduce them and will do so as soon we have taken stock of all the other numbers and know precisely what ones will probably be needed. The prices are: single numbers, six cents; volumes in loose numbers, fifty cents; volumes, neatly bound in cloth, with gilt titles on the back, $1.00 each. At these prices the volumes and numbers will be sent free to those ordering them. Postage stamps of small denomination will be received at full value for sums less than $1.00.

Correspondence.

Affection Among the Lower Animals.

Ed. Young Scientist—The enclosed paragraph is clipped from a generally reliable journal, but the story taxes my credulity somewhat. What do you think of it? MUS.

The following is the paragraph in question: "A gentleman, walking out in the meadows one evening, observed a great number of rats in the act of migrating from one place to another, which it is known they are in the habit of doing occasionally. Anxious to observe their movements, he stood perfectly still until the whole assemblage had passed close to him. Imagine his astonishment when he saw an old blind rat holding one end of a piece of stick in his mouth, while another strong and healthy rat held the other end in the same manner, and thus conducted his infirm and blind companion safely along the rough road they had to travel."

THE FAITHFUL GUIDE.

The story is an old one. We have even seen a picture of the occurrence, and have been so fortunate as to secure a copy, which we here present.

But notwithstanding the picture and the circumstantial account of the rats' proceedings, we very much fear the story had its origin in a vivid imagination rather than in actual facts. The anecdote frequently occurs in books; for example, it may be found in Porter's "Twenty Years' Recollections of an Irish Police Magistrate." Porter, however, ridicules the idea of its being true. The fact that the rats used a stick, which would not only have been a useless but an annoying encumbrance, staggers our faith in the story. We have heard of well authenticated instances of affection amongst the lower animals, quite as remarkable as the above would be if it were true.

Absorbing Pencils for removing ink blots are made by mixing 7 parts of plaster of Paris with 1 part of potato flour, moistening with the requisite amount of water, and casting into moulds. The pencils may be used for years.—*Indust. Bl., Vol. XVI., No.* 35.

Chloride of Magnesia (magnesium hypochloride), preferable to chloride of lime for bleaching fabrics, is now being manufactured cheaply from the latter, and magnesium sulphate obtained from the kieserite of Strassburg. The high price of production has until recently precluded the above article from general use in bleacheries.—*Indust. Bl., Vol. XVI., No.* 37.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS

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Some of Ingersoll's Mistakes.

MATTERS relating to religion and politics do not come within the scope of the YOUNG SCIENTIST, not because we do not attach full importance to the momentous questions which arise within these departments of human thought, but because we propose to leave them to those journals to which they are specially appropriate, while we devote ourselves to placing before our young readers those practical applications and developments of science which will give both heads and hands something to do. It is not, therefore, with any of Col. Ingersoll's religious or theological utterances that we propose at present to meddle; these we leave to other hands. But Col. Ingersoll has assumed the position of an "advanced thinker" in science as well as in other subjects; in his writings we are constantly confronted with such expressions as "modern science;" "the science of the 19th century;" "modern scientific progress;" and this to such an extent that those who are not well informed in regard to the results of modern scientific research are almost led to believe that he knows something of science, at least so far as the elementary principles are concerned, whereas the truth is that in regard to the first principles of mathematics, physics and chemistry it is demonstrable that he knows absolutely nothing, or at least (which is the same thing) nothing that is of any value to himself or any one else. He has not even sufficient knowledge to enable him to read our most popular scientific authors, such as Tyndall, understandingly, and when he attempts to quote them from memory every sentence is misrepresentation and every statement a blunder. A single specimen of his mistakes, taken from his lecture which he calls "The Mistakes of Moses," is abundantly sufficient to substantiate all that we have just said. At

page 4 of the printed lecture we find the following: "I don't believe that he [the author of a certain passage in the Bible—Ed. Y. S.] knew that it [the earth] was turning on its axis at the rate of a thousand miles an hour, because if he did he would have understood the immensity of heat that would have been generated by stopping the world. It has been calculated by one of the best mathematicians and astronomers that to stop the world would cause as much heat as it would take to burn a lump of solid coal three times as big as the globe."

It would be very difficult for any ordinary writer to compress into the same space an equal amount of blundering. In the first place it does not "take" much heat to burn a lump of coal; after the coal gets to burning it produces all the heat that is wanted. Secondly, the earth does not turn on its axis at the rate of a thousand miles an hour; a narrow band round the equator has this velocity, but as we pass from the equator to the poles the velocity becomes less and less, until finally, at the poles, the velocity is slower than that of the hour hand of a watch. The mean velocity of the earth on its axis is that of the point which lies at the centre of gravity of a semicircle of which the earth's axis is the diameter.* This velocity is very nearly 438 miles per hour, or considerably less than one-half of that stated by Ingersoll. Thirdly, a velocity of one thousand miles per hour, if converted into heat, would not give anything like the temperature claimed for it by Ingersoll. He is confounding two entirely distinct motions, and his general knowledge of natural philosophy is not sufficient to enable him to detect his error.

That the mistakes we have pointed out are really blunders, any "mathematician and astronomer" can show. But as some of our readers may not be able to follow the calculations of the "mathematician and astronomer," we may cite the following simple illustrations: Railroad cars have been propelled at the rate of over a hundred miles an hour, and stopped in a very few seconds; did anyone ever observe that they became perceptibly hot to the touch when so stopped? and yet this is nearly one-fourth of the mean velocity of the earth on its axis.

Another illustration may be seen in fly wheels and circular saws. They have been made to rotate with a velocity nearly one-third that of the mean velocity of the earth on its axis. Did any one ever notice a dangerous rise of temperature when they were brought to rest? We have never observed any such thing, although we have had considerable experience in such matters. That motion can be converted into heat we know very well, but not to anything like the extent that Col. Ingersoll claims. Axles and bearings have been made hot by friction, but the extent to which they are warmed by changing from any ordinary velocity to a state of rest is scarcely perceptible to the keenest senses.

These and other mistakes have not been pointed out by our scientific men, simply because scientific men do not read Ingersoll's lucubrations. But as a teacher of the young in this department, the YOUNG SCIENTIST would fail in its duty if it neglected to point out the grossly erroneous character of the so-called "scientific" statements which have been so widely published by Col. Ingersoll.

*This point is readily found by the formula: Distance of c from axis = ·424 r.

Ornamenting Punches.

BY REV. J. L. ZABRISKIE.

IT may be interesting to young amateur turners of wood to have a hint on ornamenting their work by means of homemade punches.

One simple example is here given which may suggest an unlimited field for invention. Fig. 1 is the top view of a box lid of wood, cut across the axis of the cylinder from which the box is made, and thus causing the ornamental pattern to be impressed on the end of the grain of the wood. This surface so shown is not one continuous plane, but is formed of three planes, slightly rising one above the other. The narrow outer ring is the top view of a beading, which has been turned around the lid. The second broader ring, ornamented with the grape-vine pattern,

is elevated by a small step above the first, and also gradually rises towards the centre. And the inner circle, ornamented

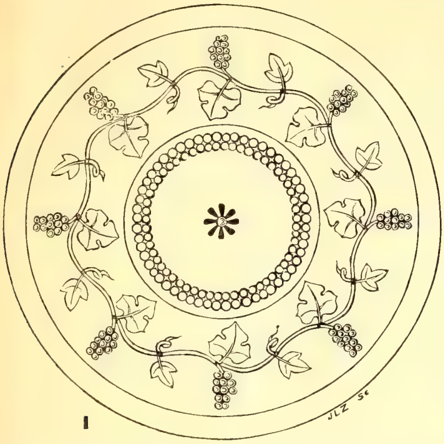
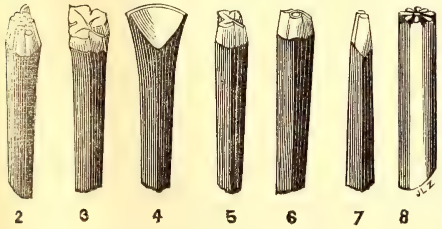


Fig. 1.—A BOX LID, ORNAMENTED WITH PUNCHES.

with a double row of minute rings and a rosette, is again elevated by a little step above the others.

Seven punches, which are shown in Figs. 2—8, are used in making this pattern. For convenience only about one-half of the length of the punches is here shown. These are made from ordinary eight-penny cut nails, with the exception of Fig. 8, which is made from a piece of stout wire. Either the head or the point of the



Figs. 2—8.—THE PUNCHES.

nail is used, according to the extent of punching surface required. Steel would be a better material for such tools. But common iron is much easier to work, and, even when used on hard wood, will stand a great deal of wear before being dulled or defaced.

Fig. 2 is a perspective view of the working end of the punch for making the bunch of grapes. It may be made in this manner: File off the top surface of the nail head smooth and true. With a small drill bore a number of shallow holes, close together, and arranged according to fancy, to form the grapes. Then, with a graver, or diamond-point tool, shown at Fig. 10, cut a moderately deep groove for the stem. And finally file away the iron, quite close up to the holes and groove, almost to a cutting edge. All the filing of this set of punches can be done with a three-cornered and a half-round file. The graver, of which the cutting end is shown at Fig. 10, is merely a small bar of square steel, hardened and ground with one face sloping towards one of the angles of the bar, so as to leave a lozenge or diamond-shaped surface, with a sharp cutting point and two cutting edges; and fitted with a suitable handle. On holding the punch to be cut in a vise, face up, and

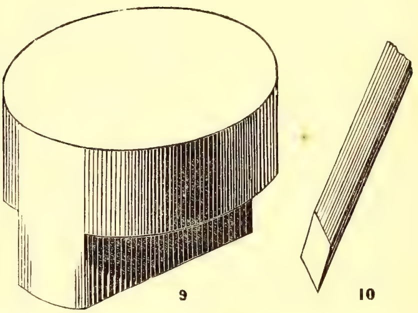


Fig. 9.—REST, FOR HOLDING BOX LID.

Fig. 10.—A GRAVER, OR DIAMOND POINT TOOL.

pushing the point of the graver, steadied by holding the tool with both hands, one will find that a little practice will enable him to engrave any ordinary lines desired on iron.

Figs. 3 and 5 are the punches for the two sizes of leaves of the grape vine. In making them, get a smooth surface on the top of the nail head; cut the veins and stem with the graver, and file away the outer portions of the iron to the desired shape.

Fig. 4 is the punch for making the vine. Engrave a semicircular groove rather deeply on the smooth surface of the iron,

and with a half-round or rat-tail file for the inside, and a flat file for the outside curve; file away the punch nearly to a cutting edge on either side of the groove. Such a groove in the punch will leave a projecting ridge on the wood, which looks much better than a mere indentation, which would be made if the surface of the punch were a solid segment of a ring.

Fig. 6 is the punch for the tendril. Cut the two curves deeply with the graver, and then file away the outside metal to correspond with the curves.

Fig. 7 is the punch for the double row of little circles. It is made on the point of the nail. Drill two shallow holes close together, and then file away the surrounding iron. And lastly, Fig. 8, for punching the central rosette, is made by drilling a shallow hole in the centre of the round iron, and then filing the gashes, and rounding the corners of the projections, to secure the desired shape.

In laying off the pattern, the main things to be attended to are to avoid breaking the box lid; to space off evenly the different parts of the design; and to secure an even depth of impression. Make a rest for holding the box lid, as shown at Fig. 9. It is a short cylinder of hard wood with a smooth upper working surface, which must be a little less in diameter than the inner cavity of the box lid, and having two pieces cut from the opposite sides of the lower end, leaving a tenon, which can be held in the vise. Place the box lid on this rest, in such manner that there shall always be a bevel and firm support directly under the punch.

Begin with punch Fig. 2. Place it perpendicularly on the surface of the lid, so that the small end of the bunch of grapes shall be near the point of the large circle, which is farthest from you, and strike the upper end of the punch with a hammer. If you are working on hard wood it may be necessary to strike two or three blows.

A little experience will show what depth of impression will give the best appearance. Now turn the lid half around on the rest, and punch another grape bunch at the opposite end of the diameter of the circle. Follow the same plan for dividing the circle into quarters. Then it will be an easy matter to divide it into eighths. Next punch the larger grape leaf, Fig. 3, allowing the leaf steam to slightly overlap the stem of the grape bunch. Then make the vine with punch, Fig. 4. It will be noticed that this part of the pattern is a reversed curve between each pair of bunches, which is made with two impressions from the same punch, by simply turning the latter half around, to get the desired direction of the curve. If the punch will not reach half way across the space between the bunches, the curve of the vine may be made longer by sliding the punch along carefully in the track of the impression just made, and then striking another light blow. Now make the impressions of the smaller leaf, and finally of the little tendril.

If all the impressions are made to slightly overlap each other, the final appearance will be better than it would be if small gaps were left in the design. The punching of the double border of little circles, and the central rosette, will be an easy matter after the vine pattern has been mastered.

This description may suggest a great variety of designs, as combinations of leaves, flowers, tendrils and other objects. And when the surrounding surface is finished with shellac and polished, such sunken designs give a very pleasing effect.

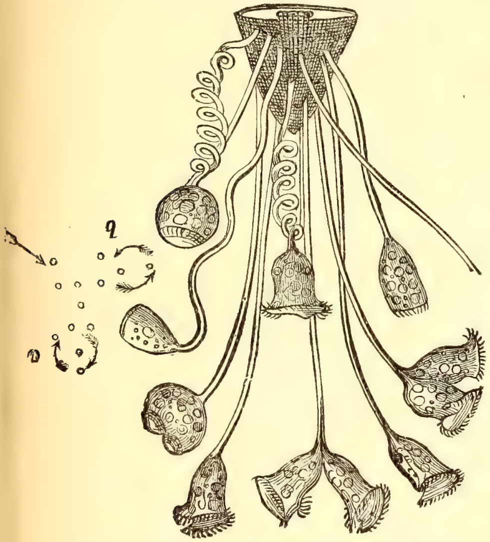
New Baltimore, N. Y., Aug., 1881.

Back Numbers and Volumes.

We can supply any back number or volume of the Young Scientist. One number (August, 1879) is now out of print, but, as the pages were electrotyed, we can easily reproduce them and will do so as soon we have taken stock of all the other numbers and know precisely what ones will probably be needed. The prices are: single numbers, six cents; volumes in loose numbers, fifty cents; volumes, neatly bound in cloth, with gilt titles on the back, $1.00 each. At these prices the volumes and numbers will be sent free to those ordering them. Postage stamps of small denomination will be received at full value for sums less than $1.00.

Marvels of Pond Life—III.

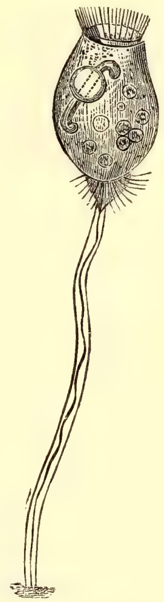
WE shall have occasion again to notice the *Protophytes*, and now pass to the *Protozoa*, of which we have a good illustration in the *Vorticella* already spoken of. In the group before us a number of elegant bells or vases stand at the end of long stalks, as shown in the accompanying engraving, while round the ends of the bells, the vibrations of a wreath of cilia produce little vortices or whirlpools, and hence comes the family name. This current brings particles of all sorts to the



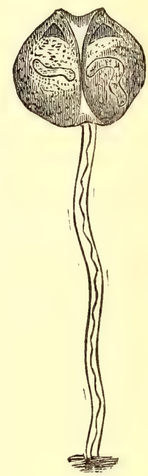
VORTICELLÆ, OR BELL FLOWER ANIMALCULES.

mouth near the rim of the bells, and the creature seems not entirely destitute of power to choose or reject the morsels according to its taste. Every now and then the stalk of some specimen is suddenly twisted into a spiral, and contracted, so as to bring the bell almost to the ground. Then the stem gracefully elongates again, and the cilia repeat their lively game.

The general effect can be seen very well by a power of about sixty linear, but one of them from one to two hundred is necessary to bring out the details, and a practiced observer will use still more magnification with good effect. They should be examined by a moderately oblique light, or most of the cilia are apt to be rendered invisible, and also by *dark ground* illumination. This may be accomplished in a well-made microscope by turning the mirror quite out of the plane of the axis of the instrument, that is to say, on one side of the space the body would occupy if it were prolonged. By this means, and by placing the lamp at an angle with the mirror, that must be learnt by experiment, all the light that reaches the eye has first passed through the object, and is refracted by it out of the line it was taking, which would have carried it entirely away. Or the object may be illuminated by an apparatus called a *spotted lens*, which is a small bull's eye placed under the stage, and having all the centre of its face covered



Vorticella, with posterior circlet of cilia in process of separation, 300 linear.—*Stein.*

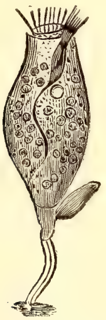


Vorticella in process of self-division. A new frontal wreath in formation in each of the semi-lunar spaces.

with a plaster of black silk. In this method the central or direct rays from the mirror are obstructed, but those which strike the edge of the bull's eye are bent towards the object, which they penetrate and illuminate if it is sufficiently transparent and refractive. Another mode of dark ground illumination is by employing an elegant instrument called a *parabolic illuminator*, which need not be described.

Different specimens and species of *Vorticellæ* vary in the length of their bells from one, three or four thousandth to one hundred and twentieth of an inch, and when they are tolerably large, the dark ground illumination produces a beautiful effect. The bells shine with a pearly iridescent lustre, and their cilia flash with brilliant prismatic colors.

The *Vorticellina* belong to the upper division of the *Protozoa*—the *ciliata*, or ciliated animalcules, and they have a mouth, an œsophagus, and an orifice for the exit of their food.



Vorticella microstoma, showing alimentary tube, ciliated mouth, and formation of a gemma at the base, 300 linear.—*Stein.*

Vorticella microstoma, the encysted animal protruding through a supposed rupture of the tunic.

Many observers used to ascribe to those creatures a complete intestinal canal, but such an apparatus is now believed not to exist in any of the Infusoria. Food particles, after leaving the œsophagus, are thrust forward into the sarcode, or soft flesh, and any cavity thus formed acts as a stomach.

The bells or cups are not, as might be fancied from a casual inspection, open like wineglasses at the top, but furnished with a retractile disk or cover, on which the cilia are arranged. Their stalks are not simple stems, but are hollow tubes, which in the genus Vorticella are furnished with a muscular band, by whose agency the movements are principally made.

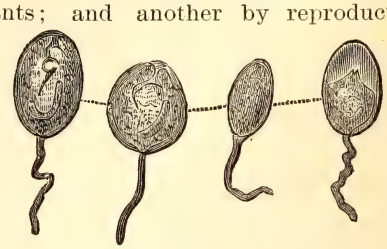
Some of the Vorticellids will be observed to leave their stalks, having developed cilia round their base, and may be seen to swim about in the enjoyment of individual life. They are also capable of becoming *encysted*, that is, of secreting a gelatinous cover.

Encysted Vorticella, showing the obliteration of special organs by the advancement of the process.—*Pritchard.*

These changes are exhibited in the annexed cuts, which are copied from known authorities. By careful observation of the bodies of Vorticellids, a contractile vesicle may be observed, which appears to cause a movement of fluids, that is probably connected either with respiration or secretion.

Another piece of apparatus in this family, but not confined to it, is the so-called *nucleus*, which in this case is of a horseshoe shape and granular texture, and greater solidity than the surrounding parts. The functions of this organ formed the subject of various conjectures, but it is now generally held to be an ovary.

In common with many of the lower animals the Vorticellids have three ways of multiplying their race. One by *fission*, or division of their bodies; another by *buds*, somewhat analogous to those of plants; and another by reproductive



Vorticella microstoma, in process of encystment, 300 linear; in the last the inclosing tunic is plainly developed,—*Stein.*

germs. These processes will come again under our notice, and we shall leave the Vorticellids for the present by observing that if they are fed with a very small quantity of indigo or carmine, the vacuoles or spaces, into which their nutriment passes, will be clearly observed. Ehrenberg thought in these and similar creatures that every vacuole was a distinct stomach, and that all the stomachs were

connected by an intestinal canal; hence his name, *Polygastrica*, or many stomached. In these views he has not been followed by later observers, and it is probable he was misled, partly by pushing the process of reasoning from the analogies of higher animals much too far, and partly by the imperfection of the glasses he employed.

How a Marine Aquarium was Started.

THE late W. A. Lloyd, Curator of the Aquaria in the Crystal Palace at Sydenham, England, gives the following graphic sketch of how he set up several marine aquaria in his early days. The account shows how difficulties which are at first sight insurmountable, may be overcome by thoughtfulness and labor. The following is his story:

There was a time, nineteen or twenty years ago, when not only shillings and sixpences were not to be thought of by me to be spent in aquarium matters, but pennies and halfpennies had to be laid out carefully. So, with artificial sea-water made from salts prepared by a Holborn chemist—which salts he kindly gave me, because I gave him the receipt for mixing them—I set up small aquaria in wide-mouthed glass bottles costing a penny or twopence each. The sea I had never seen, and was not so presumptuous as even to hope to see it, and I knew of no one living by the sea who could send me marine animals. But that daunted me not, for I used to sally forth at dead of night where heaps of oyster shells were thrown by day from street oyster-stalls in Smithfield and St. John's Street, and bring them home. The oysters devoured in such poor neighborhoods were not the genteel little smooth "natives," eaten at luncheon bars, but big rough "commoners," with bold foliations of the upper shell, and deeply ribbed on the lower one, and in and below these hiding places I could find many little sea anemones of several species, some hopelessly smashed, but others quite perfect (having been protected by the strong projections of the oyster shell), and unharmed by rain or other fresh water.

It was quite a mistake of the late Dr. George Johnston, of Berwick-on-Tweed, to say as he did, in his "History of British Zoophytes," that sea anemones are instantly killed by immersion in fresh water.

The species I found thus were *Actinoloba dianthus*, *Sagartia viduata*, *S. troglodytes*, *S. bellis*, and *S. elegans*, but very seldom the common *Actinia mesembryanthemum.*

All these I used to pick off the shells with never-wearying patience and care, and drop them into the factitious sea-water, and transfer them to my bottles, to which they adhered, and made themselves happy.

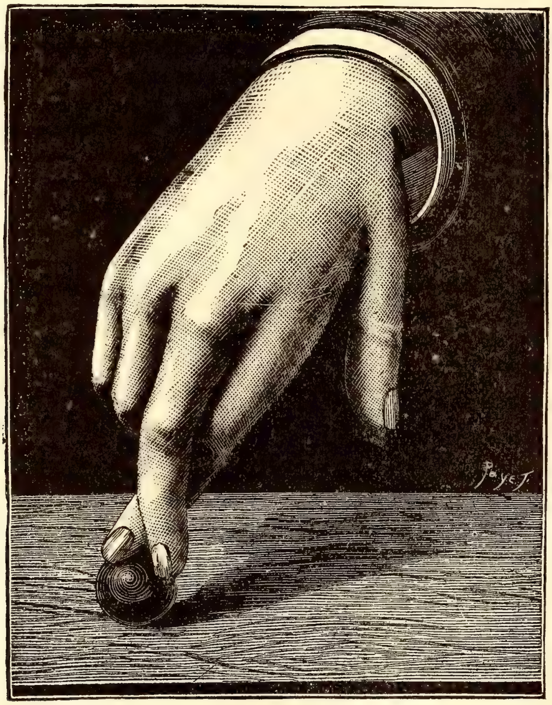
I used to feed them with little morsels of oyster-flesh which I found adhering to the insides of the shells, and when the water in the bottles would become offensive from the effects of the food, because the quantity of fluid was too small to hold enough oxygen in solution to decompose the dead animal matter fast enough, I poured the water from the little bottles into a great earthenware foot-pan covered with a sheet of glass to keep out dust, and standing in a dark corner of the room. The foot-pan was so very large in comparison with my small bottles, that the emptying of them periodically into the pan did not interfere with the purity of the water in the latter, so that from it I immediately re-filled the bottles one at a time, on successive days. The water in the foot-pan on the floor below thus effectually counteracted all tendendy at going wrong in the bottles on the window sill above.

—Certain timbers of great durability, when framed together, destroy each other. A large black walnut log, framed into a cypress gallows-tree, under shelter, both perfectly sound, in two years were discovered so badly decayed as to prevent the use of the cypress again. The walnut sawed off remained sound ten years, while the lower end of the gallows-post, where cypress was joined into cypress, remained as sound as the day it was put together.

The Ilusions of Touch.

WE all know the deceptions to which we are liable from illusions of sense. The skilful ventriloquist finds no difficulty in deceiving our sense of hearing, and the errors which we make when we trust to our sense of sight are like the auctioneer's catalogue—"too numerous to mention." Our sense of touch, however, has hitherto maintained a character above reproach; when we are in doubt as to the reality of anything which we see, or even in regard to its shape, consistence or number, an appeal is at once taken to our sense of touch, and when "we have felt it," argument is at an end.

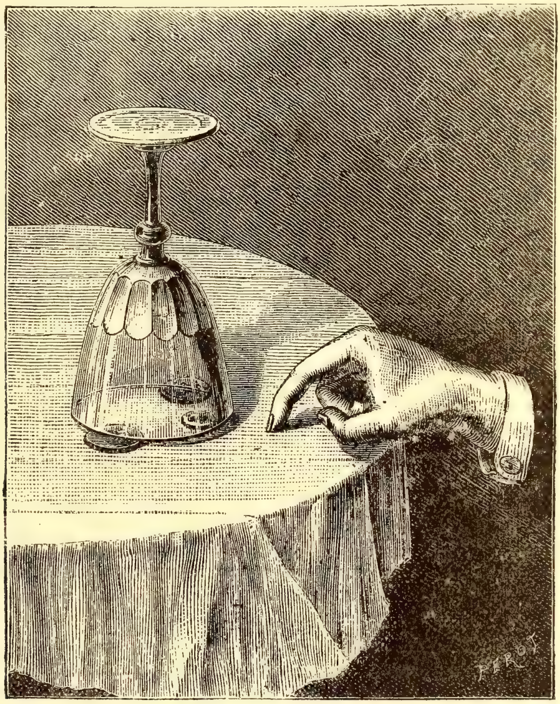
But even this severely accurate sense is liable to deception, as the following simple experiment will show: Take a pea or a small marble or bullet, and place it on the table or in the palm of the left hand. Then cross the fingers, as shown in the engraving, the second finger crossing the first, and place them on the ball, as we have figured it. If the pea or ball be now rolled about, the sensation is apparently that given by two peas under the fingers, and this illusion cannot be dispelled by the aid of the other senses, as is usually the case under similar circumstances. We may try and try, but it will be only after considerable experience that we learn to disregard the apparent impression of two objects.



ILLUSIONS OF TOUCH.

The explanation is simple enough. In the ordinary position of the fingers the same ball cannot touch at the same time the exterior sides of two adjoining fingers. When the two fingers are crossed the conditions are exceptionally changed, but the instinctive interpretation remains the same, unless a frequent repetition of the experiment has overcome the effect of our first education on this point. The experiment, in fact, has to to be repeated a great number of times, to make the illusion become less and less appreciable.

It is easy to perceive that in the domain of the sense of touch the judgment, being formed instinctively, finds itself at fault when the normal conditions are modified; thus it happens, for example, when we have on the lips an accidental pimple or swelling, the glass from which we drink appears to have a distorted edge.



CURIOUS MECHANICAL PUZZLE.

Facts of this nature are very interesting to study from a philosopical point of view, for they demonstrate that the judgment which we form in regard to external material realities is based upon the interpretation of our sensible impressions. The impression of our senses is something entirely physical, and in no wise psychological. Interpretation is an affair of habit and education.

— The first telegraph line was erected less than 40 years ago, and now 1,000,000 miles are in operation.

A Curious Mechanical Puzzle.

THE following puzzle always affords considerable amusement when first shown. Place a ten-cent piece on a table which is covered with a cloth or napkin, and over it place a tumbler or goblet, supported by two twenty-five cent pieces, as shown in the engraving. Thus arranged, the question is how to make the ten cent piece issue from beneath the goblet without touching the latter, or pushing it or drawing it out by means of some other object. To succeed in doing this it is merely necessary to scratch the table cloth or napkin with the nail of the forefinger close to the goblet, when, through the elasticity of the fibres of the fabric, motion is transmitted to the ten-cent piece, which, in consequence of its inertia, begins to move towards the finger, and escapes of itself from its prison.

A QUERY.

BY MARY H. WHEELER.

Down, down in the pool where the cypris is swimming,
  And the *Daphnia pulex* darts swiftly from sight,
Where the pink fairy-shrimp o'er *confervæ* is skimming,
  And the floscule extends her five lobes to the light.
Where the *Candona lucens*, a wandering gem,
  Creeps along a *desmidium* band,
And the fair vorticella, on sensitive stem,
  Is contracting, again to expand.
Do the small creatures know, in their homes in the ditches,
  That the dark, stormy winter is near?
And, O, what will they do, in their cold crystal niches,
  Through the long silent night of the year!

When the wee *tardigrada* is chilled into quiet,
  And the sphere of the volvox no longer is seen,
When the long-toed *dinocharis* quitteth her diet,
  And the shining Zanthidium loses its green;
When the bright hyalotheca, faded and limp,
  Lies all tangled with ulothrix bands,
And the slender synedra and staurastrum jimp
  Shall drop down to be blent with the sands,
Will the small creatures know any changeful emotion,
  Any feeling resembling our joy or our fear,
Or excitement of which human nerves have no notion,
  Through the long, silent night of the year?

Pittsfield, N. H., Oct. 25.

Care of Oil-Stones.

THE oil-stone is such an important tool in every mechanic's and amateur's workshop, that the greatest care should be taken to keep it in good order. Outside of the shops of skilled mechanics and thoroughly good amateur workers, the oil-stone is generally an unsightly and useless nuisance. Covered with gummed oil and dirt, and hollow and uneven on its surface, it is a very unsatisfactory article to work with. We know one shop where an oil-stone is used occasionally, but not enough to lead the owner to make a point of keeping it in order. He has, perhaps, a dozen which have been thrown to one side as useless, simply because they are covered with thickened oil—gummed up, as mechanics call it. As soon as the stone refused to cut the metal, it was thrown aside as useless, and a new one procured. The owner readily gave us, for the asking, one or two of these old, and, as he thought, useless stones, and we gave him a little information and advice which probably enabled him to put all the stones on his premises in order.

The first thing to do is to clean off the dirt. This is best done by means of common washing soda. Soak the stone in a strong lye for a few hours, and then rinse it off in clean water, and wipe it clean. If the stone has not been worn so as to make the surface hollow or uneven, the only thing that will be needed is to apply a little good oil. The stone will then be found to cut freely, and will be as good as new. But if the surface has been *glazed* by being used without oil, or by being used very much with oil that has become quite gummy, the stone must be refaced. The best thing for refacing stones, where it can be had, is a plate of cast iron, smeared with emery and kept moist with water. This will cut the stone very fast, and will bring out its cutting properties very thoroughly. The cast iron plate should be planed or ground, so as to make it quite level, and take the skin off. Instead of a cast iron plate, a piece of thick sheet zinc makes a very good grinder. The emery should be fine, and plenty of water should be used. Even a sheet of glass paper or emery paper, laid

evenly on a board, and used dry, will renew the surface of an ordinary oil-stone. Or a block of sand-stone, which has been dressed straight, will do. The following plan has been highly recommended by a correspondent of the *Scientific American*. He says: "I have, in the course of my life, spent a good deal of time in facing off my oil-stones. I have used sand on a board, wet and dry, or an old millstone, or a hard brick. If the oil-stone was soft, it could be cut or rubbed down in a short time; but if a hard one, it was a serious job. The thought struck me, about two years ago, that emery would be the thing to quickly cut a hard stone which I have. I dressed off a white pine board, put a thin coat of glue on it, when dry put on another, sprinkled coarse emery on the glue, rubbed it in well, and when dry put on another coat of glue and emery. I have been using it ever since; it does not take one-tenth of the time to face off that stone that it formerly did with sand, etc. This may save some one some hard rubbing."

When a stone has once been brought into good condition, try to keep it so. Never use it without a liberal supply of good oil, which *must* be of some non-drying kind, if you would keep the stone in order. Olive oil or sperm oil is what we use. We have tried soap, glycerine, kerosene, etc., etc., but find that although they work well for a few minutes, they soon spoil the stone. As soon as you have finished your work, wipe the stone off clean, and cover it up to keep it from the air. The best way is to keep it in a wooden case, carefully fitted to it, but when the stone has no case, wrap it carefully in several folds of paper. No stone will do good service unless the surface is kept even and straight; therefore avoid using the middle of the stone more than the ends, and as soon as any part gets worn below the general level, have the whole surface dressed off even.

—Iridium is the least fusible of all metals, requiring a temperature of about 3500° Fahr. Platinum melts at about 3200° Fahr.

Editorial Notes.

Our January Number.

THIS will contain several finely illustrated and interesting articles, including a handsome frontispiece, which illustrates a very singular experiment. The article on Pond Life will be continued, and there will be articles of great practical value on the Aquarium, the Turning Lathe, Makeshifts for Young Microscopists, etc., etc. The first of a series of three articles on Cutting and Engraving Glass. This series will include a very simple arrangement for the sand-blast. Our young friends should be careful not to miss this number.

A Word to Our Subscribers.

THE present year is drawing to a close, there being but one more number to be sent to each subscriber. That number will contain index and title page, so that those who wish to have their journals bound can have a complete book.

For the coming year we have made such arrangements as we believe will enable us to give our readers better satisfaction than ever before. It is our purpose to steadily improve the YOUNG SCIENTIST, and we intend that every number shall be better than those that have preceded it. That we may be able to do this, however, we must secure the help of our subscribers. We ought to have a subscription list double what we now have—at least fifteen thousand—and we can easily do this if our friends will only help us. Let each one of our subscribers send in a new name and the thing is done. But remember we do not ask you to do this for nothing. We are willing to pay, and pay well, for this little service, and therefore we make the following liberal offer, which will hold good until the 25th of December, Christmas day. Those who wish to work for money, may retain fifteen cents out of the fifty received for every *new* name they send us. Those who wish books, can have twenty-five cents worth of any of *our own* publications for every fifty cents that they remit for a new name. Thus

four new names would secure Pemberton's work on Drawing, or Phin's large book on the Microscope. Three new names will secure Shooting on the Wing, or The Steel Square. One name and ten cents will secure a copy of the Workshop Companion—a book which contains more for the money than any other volume that we know of. For other premiums we refer to our advertising pages.

Electrical Humbugs.

THE wonders which can be actually performed by electrical agencies are so marvellous that it is no wonder that the public in general have unlimited faith in the powers of this force. In the presence of the telegraph, the telephone, the electric light and a dozen other successful applications, he would be a bold man who would pronounce against the possibility of any achievement. This fact does not, however, prevent us from deciding against certain obvious humbugs and swindles which are to-day too common. Electricity has its laws as well as gravitation, and the man who proposes a scheme to which they are obviously opposed is either a fool or a knave. Some of the swindles which are now before the public are exceedingly barefaced, and yet they are wonderfully successful in drawing the money out of the pockets of the people, and the most emphatic testimonials from "respectable" clergymen. One man sells a hair-brush for which is claimed all the virtues under heaven—all due to electricity. To convince the gullible portion of the public that the brush has great electrical power, those who sell it exhibit its action on a magnet, and as the brush is apparently made of non-magnetic material, the effect is supposed to be due to the electricity which is somehow stored in the brush. The fact is, however, that there is a small steel magnet concealed in the substance of the back of the brush, and it is to this that the action is due.

Others present to the public what they call magnetic or electrical garments under various names. What adjectives are too strong to characterize the fraudulent claims made for these articles? That electricity is a most valuable remedial agent when properly directed and judiciously applied there can be no doubt. But these men know nothing either of electricity or medicine; all they want is money, and they make up for the lack of knowledge by the most unblushing assurance and the most lying claims. The articles which they sell, violate the most elementary principles of natural science, and our young readers are cautioned to beware of them. The most astonishing thing is that their advertisements are admitted into professedly scientific, and even into some medical papers, thus lending to them a *quasi* endorsement which no respectable paper should give even in its advertising columns.

Death of Charles A. Spencer.

THIRTY years ago the scientific world was thrown into a ferment by the announcement that "an object-glass, constructed by a young artist of the name of Spencer, living in the back woods, had shown three sets of lines on a very delicate diatom, when other glasses of equal power, made by the first English opticians, had entirely failed to define them." This passage, which marks an era in the history of the microscope, occurs in the first edition of Quekett's work on the Microscope, but has been expunged from subsequent editions. At that time Ross had declared that an angle of aperture of 135° was as great as could be given to the object-glass of a microscope. Spencer, with a true American unbelief in the impossible, went to work, and in a short time succeeded in making glasses having an angle of aperture of 172°, and since that time the angle has gone on increasing, its increase being an accurate indication of the advancement of microscopy. Spencer was an entirely self-taught optician, and his talents and success made American microscopes known all over the world. He died at Geneva, N. Y., on the 28th day of September, 1881, at the age of 68 years.

A fine portrait of Mr. Spencer, together with a lengthy biography, will appear in the forthcoming number of the *American Journal of Microscopy*.

Correspondence.

How to Sharpen a Pencil.

Ed. Young Scientist—In your prospectus you say that the YOUNG SCIENTIST is for teaching us *how to do things*. Now, I would like very much to know the best way to sharpen a pencil. Papa has bought me two or three pencil sharpeners, but they are no good. When I use a knife I dirty my hands up, and the point of the pencil breaks, and it is just awful. Please tell me how, and also what is the best sharpener, and I will thank you ever so much. Yours,

A LITTLE GIRL.

The experience of our young friend is the same as our own; we have never found a pencil sharpener that we would accept as a gift. The best pencil sharpener is a good sharp knife, and with it, it is easy to give a pencil either the round, conical point used for writing, or the flat, chisel point used for drawing lines.

First of all, remove the wood with a series of long clean cuts; do not hack and nibble it, making it look as if the rats had eaten off the end. This requires a sharp knife, and, if your hand is large enough, the best way to hold the pencil is to lay the end on your thumb, and hold the knife in the four fingers. If your hands are small you had better hold the pencil in the left hand, point outwards, and cut away from you; in this way all danger of cutting yourself is avoided. Do not attempt to cut the lead until you have cut away the wood so as to leave about one-eighth of an inch exposed. As the lead is quite brittle it must be supported, and most persons lay it on their thumb, allowing the powdered black lead to fall all over their hands, soiling them in a very disagreeable manner. In addition to the dust, however, the point of the pencil is very apt to be broken, since the flesh is soft and yielding. Therefore, the best plan is to lay a piece of paper on a table or board, and on this lay the point of the pencil, flat. You can now shave off the black lead without any risk of breaking it, and by constantly turning the pencil round, a beautiful conical point may easily be given to it without in the least degree soiling the hands or anything else, except the waste paper, which may be thrown away.

To carry out these directions, however, it is necessary to have a sharp knife, and one of which the blade is not too soft. Draughtsmen and engravers frequently use a file or a piece of fine sand-paper for sharpening pencils, and they answer admirably. But after all we prefer a good sharp knife.

BOOK NOTICES.

Trichinæ (Pork Worms, or Flesh Worms): How to Detect Them and How to Avoid Them. Being a Popular Account of their Habits, Modes of Propagation, and Means of Dissemination. Intended for the Use of Farmers, Butchers, Pork Dealers, and Consumers of Pork. By John Phin, Editor of the *American Journal of Microscopy*. Rochester: The Bausch & Lomb Optical Company.

This little pamphlet has not been written from an alarmist standpoint, although it points out clearly and forcibly the danger to an important article of commerce if steps be not taken to stamp out what a German author calls "man's most dangerous enemy." So far as human beings are concerned, it has been clearly shown that we have, in the simple process of *thorough* cooking, a perfectly efficient means of killing trichinæ and all other parasites. But in order to be effectual, the cooking must be *thorough;* no mere surface scorching on the one hand, or brief dipping in boiling water on the other. It has long been known that a lump of flesh, placed in boiling water, may be very thoroughly cooked on the outside, while the interior has not reached a temperature high enough to destroy any parisite that may be present. And if this process of cooking be applied to all animal food given to pigs, dogs and cats, and if it be made a serious offence to manure with animal offal, land on which are to be grown grass or vegetables that are eaten in a raw state, the trichinæ would soon be "stamped out."

This pamphlet, which may be obtained free from the Bausch & Lomb Optical Company, of Rochester, N. Y., gives very clear engravings, showing the trichinæ at its different stages, and it also describes a very simple and efficient instrument for detecting the pest.

Practical Hints on the Selection and Use of the Microscope: Intended for Beginners. By John Phin. Editor of the *American Journal of Microscopy*. Fourth Edition. Thoroughly Revised and Greatly Enlarged. Illustrated with six plates and 80 figures in the text. New York: Industrial Publication Co.

It is but a short time since we noticed the issue of the third edition of this work, and yet that edition is already exhausted and a fourth published. Some additions have been made to this edition, and the work is now so large that the publishers no longer find themselves able to sell it for seventy-five cents. The price has therefore been raised to one dollar. While it never can prove a substitute for the larger works of Beale, Carpenter, or Frey, it has shown itself to be a most useful volume for the beginner and the amateur.

The Rain Drop: A Monthly Miscellany of Entertaining Reading for Young People. Pittsburgh, Pa.: James Logan.

We have frequently noticed this interesting journal during the course of its publication, and now that it has closed its career, we call attention to it as one of the very best Christmas gift books

within our knowledge. The matter does not consist of mere clippings, but of carefully edited matter, which is of real value both to old and young. Here we find the Romance of Reynard the Fox, which will interest the little folks for its story, and the older people for its folk-lore, and the many allusions which have been made to it in the better classes of literature. Every member of the family will find something in it; the little ones lisping for a story will find Jack the Giant Killer and John Gilpin; older ones will find the story of Romulus and Remus, and still older ones may read with pleasure, as we have done, the Romance of Reynard the Fox and the story of Robin Hood. The book forms a handsome quarto of nearly 400 pages.

E. & F. N. Spon have now ready a Descriptive Catalogue of Books for Mechanical Engineers, and will send it free, on application. Address 446 Broome Street, New York.

An Ingenious Æolian Harp.

In a former number of the YOUNG SCIENTIST we gave very full directions for constructing an æolian harp, and our readers will no doubt be interested in the following account of a rather complicated but very ingenious instrument of this kind. It seems that some time ago a son of Mr. George Ellwanger, of Rochester, N. Y., while traveling in Germany, became impressed with the agreeable combinations of tones produced by æolian harps, and, on returning home, mentioned the circumstance to his father. The latter soon conceived the idea of erecting an æolian harp on his tower near Mount Hope. A suitable man to make the instrument was found in Professor C. Dennebecq. The sounding-board is to be of Norway pine, seven feet high, and the back of hard curled maple of forty-five years' cut. These woods are all imported, the slow growth of European woods giving them a texture better adapted to musical instruments than the home products.

As a whole, the instrument is to be tube-shaped, with eight slots in the tube. The latter is to be surmounted with a lightning rod, eight feet high, with a weather-cock attached. Right here is where Professor Dennebecq introduces a new design of his own; for with every turn of the weather-cock a slot is presented to the wind and a string is made to vibrate. The first string that is made to vibrate in this manner gives the fundamental note, while the other will sound a third and give the acute octave to the first. Prof. Dennebecq has no doubt as to the success of his instrument, and thinks when completed and placed on the tower it can be heard on still nights for a distance of three miles up the river. He made a similar instrument for the Sorbonne in Paris, which, however, is not automatic, but must be arranged by the janitor before it will work.

The constructor of these instruments is a pupil of the celebrated Villaume, and gave three years of his life to learn the trade of repairing his own violin. This violin was one of Steiner's make, who was a pupil of Amati, and whose violins have a reputation that is world-wide. Prof. Dennebecq himself has acquired a reputation as a violin maker and restorer, and is conversant with the mechanism not only of this, but of several other musical instruments.

Before leaving the subject we may mention the colossal harp erected at Milan in 1786 by the Abbe Gattoni. He stretched seven strong wires, tuned to the notes of the gamut, from the top of a tower, sixty feet high, to the house of a Signor Moscate, who was interested in the success of the experiment. This apparatus, called the "giant's harp," in windy weather yielded lengthened peals of harmonious music. In a storm it was sometimes heard at a distance of several miles.

In many places where the telegraph wires are strained sufficiently tight, these structures form gigantic æolian harps. As a general rule, however, they are not strained tight enough to give a full sound, and they have no sounding boards.

The Toad.

The whirligig of time brings about strange revenges, and among them may be noted the recent accession into favor of the long-despised and much-maligned toad. For centuries these harmless animals have been persecuted and reviled till their very name has passed into a byword descriptive of disgust and loathing. At last, however, their unobtrusive virtues are obtaining recognition, and the value of the unhandsome toad as an insect destroyer is now generally admitted. At the present time a "toad market" is held regularly in Paris, once a week, on an open space of ground in the Rue Geoffrey St. Hilaire, at the back of the Jardin des Plantes, whither the dealers in this novel article of commerce bring their wares, carefully assorted according to their strength and size, and packed by the hundred in baskets of damp moss. Whence the supply may be derived is as yet a mystery, but it seems clear that they are not over-abundant, since those of moderate size find ready purchasers at prices ranging from seventy-five to eighty francs per hundred. By far the greater portion of them are bought up for the use of English market gardeners, and it is stated that orders are to hand at Paris for the purchase, at current rates, of every basketful sent to market.—*London Farmer.*

Improved Carmine Ink.

The solubility of carmine lake in caustic aqua ammonia is attended with this disadvantage; that in consequence of the alkaline properties of ammonia, the cochineal pigment will, in time, form a basic compound, which in contact with a steel pen no longer produces the intense red, but rather a blackish color. To avoid this evil, prepare the ink as follows: Saturate 1 gramme of pure carmine with 15 grammes of acetate of ammonia solution and an equal quantity of distilled water, in a porcelain mortar, and allow the whole to stand for some time. In this way a portion of the alumina which is combined with the carmine dye, is taken up by the acetic acid of the ammonia salt, and separates as precipitate, while the pure pigment of the cochineal remains dissolved in the half saturated ammonia. It is now filtered, and a few drops of pure white syrup added to thicken it. In this way an excellent red drawing ink is obtained, which holds its color for a long time. A solution of gum arabic cannot be employed to thicken this ink, as it still contains some acetic acid, which would coagulate the bassorine, which is one of the natural constituents of gum arabic.—*English Mechanic.*

Practical Hints.

Red Oak as an Ornamental Wood.—Red oak is found in abundance in almost all parts of the country, and from its plentifulness and its unsuitableness for a large majority of the commercial uses to which white oak is utilized, has been looked upon with a contempt, but little deserved when its adaptability to the manufacture of furniture is taken into consideration. It is more brittle than white oak and more porous, and this has probably been the cause of its neglect for shipbuilding purposes, combined with the fact that it is more susceptible to the attacks of the marine insects which abound in salt water. It is not a wood which will stand the variations of wet and dry; and while white oak was to be had in abundance, the red oak was thought fit only to be made into flour barrels. When sawed bastard, so as to fully develop the grain, there is no question of its beauty being equal to black walnut, in the eyes of those who are not prejudiced in favor of the rich dark color of the latter.

Fine Linen.—According to the *Building News*, a piece of linen has been found at Memphis containing 540 picks to the inch, and it is recorded that one of the Pharaohs sent to the Lydian king, Croesus, a corselet made of linen and wrought with gold, each fine thread of which was composed of 360 smaller threads twisted together! The ancient Egyptians wove a linen called the "linen of justice," or "justification." So beautiful and valuable was it that it was esteemed the most acceptable offering to the "Restorer of Life." A few hand looms can be seen at work in the Eastern bazaars of Cairo, the cloth woven in which rivals in texture, color and design the finest glass screens of Munich.

Improved Varnish for Special Purposes.—Moreau, of Paris, patents the following improved varnish: Infuse 195 grammes of gum sandarach in one-fourth litre spirits of wine; also 120 grammes spirits of turpentine in three-fourths litre spirits of wine. Stand the two infusions in a water bath for half an hour; then mix, and place the mixture in the water bath for fourteen minutes more. Allow it to stand for twenty-four hours, and filter through cotton. The result is a colorless varnish, which may be given any desired tint with saffron, Prussian blue, indigo, etc. The patentee states that the effects resemble those formerly produced by the famous "Vernis Martin," the secret of which is now lost.

A New Cake Tryer.—A broom splint has occupied a prominent position among aids to cooking for an indefinite period of time, and housekeepers who are immaculate in all other matters often take a splint from a broom with which they have perhaps swept the kitchen, and "try" a delicate cake with it. A much better way is to buy a cheap little "brush broom," and keep it for this and no other purpose; one will last a lifetime; hang it in the dining-room near the kitchen door. If so disposed you can make a pretty case for it of fancy paper or Turkish towelling, then one will not be tempted to use it for anything else in the kitchen.

Fine Drilling.—Professor Edward C. Pickering, of Harvard College, says that in undertaking to measure the intensity of the light of the satellites of Mars, he had occasion to need an extremely small hole. Among the artisans who essayed to furnish what was required was one who had succeeded in making a hole edgewise through an old fashioned three cent piece, and another who had pierced a needle through from end to end. A hole about the twenty-five hundredth part of an inch in diameter was finally secured.

Cheap Pencil-mark Eraser.—Caoutchouc is dissolved in carbon disulphide, the solution is intimately mixed with enough starch flour to form a dough, and exposing the mass, in suitable pieces, to the air, until all odor of carbon disulphide has disappeared. The product is an excellent eraser for lead pencil marks from paper. If, in addition to starch flour, finely powdered pumice stone be added to the mass, it will be suitable for erasing ink marks or writing from paper.—*New Remedies.*

Blue Ink.—Take Berlin blue, 6 parts; oxalic acid, 1 part. Mix thoroughly into a soft paste with water. Dissolve in rain water, and add a little gum arabic.

QUESTIONS AND ANSWERS.

Drilling Glass.—In the number of the Young Scientist for August, 1880, page 100, you give a short note on "Drilling Glass," and tell us how *not* to do it. Will you please tell us *how* to do it?

Ans.—There are three ways of drilling glass: One is with a diamond drill; the second is with a soft metal drill charged with sand or emery, and the third is by means of a steel drill. A hard steel drill, lubricated with sulphuric acid, or with camphor dissolved in turpentine, will cut glass very rapidly. We have frequently bored a hole a quarter of an inch in diameter through a thick plate of glass by means of such a tool. The diamond drill, for holes over a quarter of an inch in diameter, consists of an iron tube with splinters of diamond firmly stuck into holes bored on the outer and inner edge of the tube. For small holes an iron rod charged with diamond powder answers well. Copper drills, made either of copper rod or copper tubing, according to size, answer well. They are kept charged with emery or sharp sand and water, and the drill should be guided by a block of wood cemented to the glass. The wood has a hole bored through it the exact size of the drill. This hole is placed exactly over the spot where the proposed hole is to be, and prevents the drill from slipping about.

Power of Eye-pieces and Objectives.—Can you tell me what is the standard of power for the different objectives marked A, B, C, D, E, etc.? I have a microscope with very good objectives and eyepieces, marked A and C, and I feel satisfied that the objectives will give good definition with much higher magnifying power than I now get. What power will I get if I procure a D eye-piece?

Ans.—The values of the different eye-pieces vary with different makers, and this to such an extent that unless we knew who was the maker of your microscope we could give you no accurate information on the subject. The eye-pieces made by Ross twenty years ago, as given by Brooke, were as follows:

Name of Eye-piece.	Focal Value.	Magnifying Power.
A	2·7 inch	3·7 times.
B	1·6 "	6 "
C	1· "	10 "
D	·6 "	17 "
E	·4 "	25 "

and this scale seems to have been pretty closely followed by most makers. So that a D eye-piece on the above scale would give you a magnifying power rather more than one and a half times what you now get.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business letters or cards they cannot be used.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

Magic lantern, in good order, condensing lens, 2½ in. diameter, 8 slides. For small photographic camera or offers. H. A. Giddings, 4 Union Place, Classon Ave., Brooklyn.

Fifty canary birds, with and without crests; fancy poultry, conch shells, strombus alatus. For small printing press, books on natural history, or offers. Frank Lattin, Gaines, N. Y.

Printing press, type, etc., worth $13, for offers. E. G. Vogeley, 1010 Bradford St., Pittsburgh, Pa.

A good plain 7 shot revolver, 22 calibre, for a Students' inch or half-inch objective. Frank F. Colwell, Urbana, Ohio.

Wanted, Printing press and type, in good order, chase 6 x 10, or larger; will give hardware, tools, scroll saw, or designs. Chas. E. Little, 59 Fulton St., New York.

Photo outfit, tools, chemicals and apparatus, etc., etc.; wanted scientific books, apparatus, etc.; send lists. A. B. Campbell, Box 59, South Dayton, Catt. Co., N. Y.

Stuffed birds, insects or job printing (cards, labels, etc.) for mounted objects for the microscope. James P. Melzer, Milford, N. H.

A ring stand, filtering stand, calcium light jet and a gas holder, holding one cubic foot, for a phonograph. D. P. Smith, 59 Park Place, New York.

To exchange, Hugh Miller,s "Cruise of the Betsey," and "The Old Red Sandstone," cloth bound geological books, for lathe, hammock, or "Gray's Manual of Botany." Gus. C. Spaeth, Mt. Carmel, Ills.

F. F. F., Lock Box 83, St. Johnsbury, Vermont, would like to exchange or correspond with persons interested in mineralogy, Oology, philatology, Indian relics, books, entomology, numismatology, etc.

Wanted, a good printing press and type; state what is wanted in exchange. H. A. Kinney, Hamlin, Brown Co., Kansas.

I have a printing press and outfit (cost $15) to exchange for books, microscope, tent, watch, or offers. Henry E. Jacobs, 59 Harvard Street, Boston, Mass.

I have Vols. 2 and 3 of "Nests and Eggs of American Birds," to exchange for Vol. I of Young Scientist, or offers. N. B. Stone, Lock Box 9, Putnam, Conn.

Wanted, a printing outfit or offers, in exchange for baritone cornet, air gun, and other things, a list of which will be furnished upon application. E. S. Nixon, Jr., Box 345, Chattanooga, Tenn.

To exchange, minerals, ores, shells, papers, magazines, books, coins, stamps, for stamps, coins, minerals, stylographic pen, telephone, etc. A. M. Beveridge, P. O. Box 854, Appleton, Wis.

Will exchange minerals for other minerals; state what specimens you desire. E. A. Refsnyder, Phœnixville, Chester Co., Pa.

Wanted, a good powerful second-hand microscope; forward engraving of instrument, stating price, or what is wanted in exchange. L. D. Snook, Barrington, Yates Co., N. Y.

Wanted, botanical specimens of Western, West Coast, and Southern ferns, in exchange for Northern species; lists exchanged. H. N. Johnson, Coeymans, N. Y.

Wanted, copy of "Snowball's Elementary Natural Philosophy." M. B Tausy, Harrisburg, Pa.

A new 2 x 4 engine, worth $60, for a first-class bicycle; also a watch, revolver, and gas stove, for a 6 x 9 printing press, type, or offers. Geo. L. Lamson, La Fargeville, N. Y.

To exchange, specimens in botany, oology, etc., for those in other localities; botanical correspondents desired. Arthur Fairbanks, St. Johnsbury, Vt.

To exchange, for other books on scientific and industrial subjects, "Moore's Universal Assistant," "The Young Mechanic;" both quite new. Fred. Whitehead, Box 55, St. Augustine, Fla.

A German microscope, with 3 objectives and 5 eye-pieces, condensing lens, etc., resolving Pleurosigma angulatum, will be exchanged for a first-class spectroscope. Clarence L. Speyers, 50 West 17th St., New York.

I have a fine concert harmonica, 20 notes, with case, but little used, that I will exchange for Vol. 3, of the Young Scientist. Charlie O. Wells, Hatfield, Mass.

To exchange, birds' eggs and minerals, for minerals, ores, and curiosities. H. G. Emery, 51 Spencer St., Albany, N. Y.

THE

Young Scientist.

A PRACTICAL JOURNAL OF

HOME ARTS.

"KNOWLEDGE IS POWER."

VOLUME V.

January to December, 1882.

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CURIOUS EXPERIMENT ON INERTIA.

THE Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

VOL. V. NEW YORK, JANUARY, 1882. No. 1.

Illustration oı Inertia.

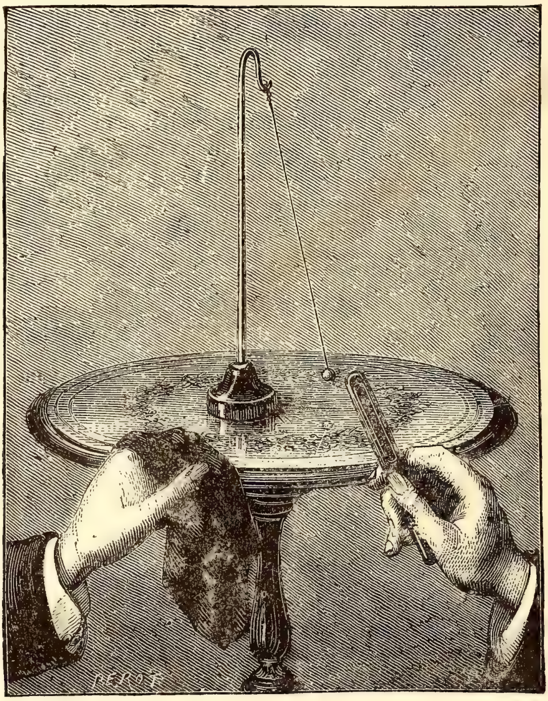
A CURIOUS experiment is sometimes performed by itinerant physicists, and which may be described as follows: A broom handle is laid horizontally on two annular bands or rings of paper. Then two boys are selected, and each having been provided with a razor, they are required to support the broom handle with these, the cutting edge of the razors being uppermost and in contact with the intervening paper. All being in readiness, the operator takes a stout stick, and, with all his strength, strikes the broom handle in the middle, when, much to the surprise of the spectators, the latter is broken into slivers, while the paper bands which supported it are not even cut by the razors. The experiment which is figured in our frontispiece, and which is based on the same principle, may be performed as follows: First, drive a needle into each end of a broom handle; then, having procured two goblets, place each one near the edge of a chair, and from one to the other suspend the broom handle horizontally by means of the needles. If, now, the broom handle be struck a sudden and powerful blow with a stout stick, it will be broken and the goblets will remain intact. The more powerful the blow the more successful will be the experiment. The phenomenon is explained by the resistance of the inertia of the broom handle. The blow being given suddenly, the impulse has not the time to communicate itself from the molecules directly struck, to the neighboring ones, and the first molecules separate from each other before the motion can be transmitted to the goblets, which serve as a support.

—Miss Margaret Hicks, who has recently graduated from the course in architecture at Cornell University, is said to be the first woman who has ever adopted architecture as a profession.

Electrical Experiments.

VERY interesting electrical experiments may be performed by means of very simple apparatus. For example, to show electrical attraction and repulsion nothing more is necessary than a few small cuttings of paper and a stick of sealing wax. When the sealing wax is rubbed it becomes electrically excited and will attract the paper, which, however, soon flies off again after being charged from the wax. Another way of illustrating this curious principle is shown in the accompanying engraving. Take any heavy block for a foot (an old paper file answers well) and fasten on it a wire curved and hooked as we have shown. To this hook at the upper end of the wire attach a silk thread, and to the end of the thread fasten a ball made of the pith of the elder, the sun flower, or Indian corn. Teachers who wish a large ball, visible at a distance, may use two paper hoops about an inch and a half in diameter, and one inch broad. One of these hoops is passed through the other, so that they cross each other and form a sort of skeleton ball. When a stick of wax which is dry, warm and well rubbed with flannel, is brought near such a ball, the latter will swing towards it like a pendulum.

Instead of a stick of wax, a very good substitute is a short, stout sheet of brown paper rolled into a cylinder or tube. The tube should consist of several folds of paper, so as to be quite stiff, and the edges should be fastened down with sealing wax. Such a tube, if strongly heated and well rubbed with flannel, gives very powerful effects. Indeed, in order to obtain an electrical spark, all we need is a simple sheet of paper. A large sized sheet of thick drawing or good brown paper is taken, strongly heated, and laid on a wooden table. It is then rubbed with the dry hand or a piece of flannel until it

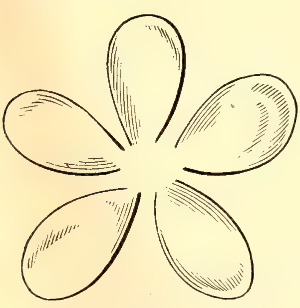


AN ELECTRICAL EXPERIMENT.

adheres to the table. A bunch of keys is now laid in the middle of the paper, and the latter is raised up by two of its corners. If at this moment some one presents his knuckle o the bunch of keys he will draw from it a brilliant spark. If the weather be very dry, and if the paper has been well heated several times, the spark may attain a length of over half an inch. A spark may also be obtained by rubbing a glass tube with a piece of silk and approaching the knuckles to it. The human body may also be electrically charged, so as to yield a spark, by rapid sliding over a carpet, and gas may be lighted by the spark so produced. But in order to show energetic effects, the charge must be accumulated and concentrated. This is best done by means of the Leyden jar, and in our next article we will tell our readers how to make a very simple apparatus of this kind.

Imitation Flowers Made with Liquid Films.

A PRETTY experiment has been recently described by the well-known Belgian physicist, M. Plateau. He bends fine iron wire as in the figure, so as to present the contour of a flower of any number of petals. The central ring to which the petals are attached is supported on a forking stem, which is stuck in a piece of wood. After oxidizing the wire slightly



FRAME FOR LIQUID FILMS.

with weak nitric acid, the flower is dipped in glycerine liquid, so as to receive films in the petals and the central part. It is then turned up, placed on a table near a window, and covered with a bell jar. For a short time at first it appears colorless, but soon a striking play of colors commences. In the experiment described by M. Plateau, the flower continued showing modifications of color for ten hours, when dusk stopped observation. Next morning several petals had burst, the liquid used having been of very inferior quality. M. Plateau recommends preparation of the liquid thus: Dissolve a fresh piece of Marseilles soap, cut up into small pieces, in forty parts by weight of hot distilled water. Filter after cooling, and mix thoroughly three volumes of the solution with two of Price's or any other pure and heavy glycerine. The solution should be left at rest till all air bubbles are gone.

Blue Process of Copying Drawings.

THIS process is so simple and involves so little trouble that it has been almost universally adopted by engineers and mechanical draughtsmen. The following are the details as given by Mr. P. Barnes, of Springfield, Ill., before the American Institute of Mining Engineers:

1. Provide a flat board as large as the tracing which is to be copied.

2. Lay on this board two or three thicknesses of common blanket, or its equivalent, to give a slightly yielding backing for the paper.

3. Lay on the blanket the prepared paper, with the sensitive side uppermost.

4. Lay on this paper the tracing, smoothing it out as perfectly as possible, so as to insure a perfect contact with the paper.

5. Lay on the tracing a plate of clear glass, which should be heavy enough to press the tracing close down upon the paper. Ordinary plate glass of three-eighth inch thickness is quite sufficient.

6. Expose the whole to a clear sunlight, by pushing it out on a shelf from an ordinary window, or in any other convenient way, for six to ten minutes. If a clear skylight only can be had, the exposure must be continued for thirty or forty-five minutes, and under a cloudy sky, sixty to ninety minutes may be needed.

7. Remove the prepared paper and

drench it freely for one or two minutes in clean water, and hang it up by one corner to dry.

Any good hard paper may be employed (from even a leaf from a press copy book up to Bristol board) which will bear the necessary wetting.

For the sensitizing solution take 1⅞ ounces citrate of iron and ammonia, and 8 ounces clean water; and also, 1¾ ounces red prussiate of potash and 8 ounces clean water; dissolve these separately and mix them, keeping the solution in a yellow glass bottle, or carefully protected from the light.

The paper may be very conveniently coated with a sponge of 4 inches diameter, with one flat side. The paper may be gone over once with the sponge quite moist with the solution, and a second time with the sponge squeezed very dry. The sheet should then be laid away to dry in a dark place, as in a drawer, and must be shielded from the light until it is to be used. When dry, the paper is of a full yellow or bronze color; after the exposure to the light, the surface becomes a darker bronze, and the lines of the tracing appear as still darker on the surface. Upon washing the paper, the characteristic blue tint appears, with the lines of tracing in vivid contrast.

It will readily be seen that the process is strictly photographic in the ordinary sense of the word—the tracing taking the place in the printing of the ordinary glass negative. Hence, all details are closely reproduced, even to the texture or threads of the tracing cloth.

A working drawing thus made furnishes its own background, and does not require to be placed over a white ground, as is often the case with a tracing. If desired, the copy can be made upon common bond paper, which can be mounted upon a board in the usual way.

Inasmuch as such copies can be made from tracings only, it may be well to suggest, and urge, that drawings can be completed, or nearly so, in pencil upon paper in the usual way, and that all the inking can be done upon tracing cloth laid upon the pencil-work. In this way the cost of the tracing (in the ordinary sense) can be wholly saved, and the single copy of the finished tracing can thus be made in the "blue" way, to the best possible advantage.

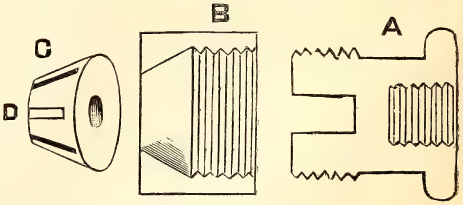
It may safely be said that this method of copying can be employed, if only one or two copies per week are needed of ordinarily complex drawings, with excellent results, and with a very important saving of both time and money.

A ready means of adding to or correcting the blue copies may be found in the use of a solution of carbonate of soda or potash, used with a pen or brush.

A Home Made Chuck.

A CHUCK for small lathes, made after the following plan, does not cost much for material or time, and will be found very useful:

A is a piece of brass to screw on the mandril. It has an external screw on the outer end to receive the brass cover B. The inside of the outer end of B is conical, and C is a piece of wood turned to fit it. When B has been screwed down tight, a



A SIMPLE CHUCK.

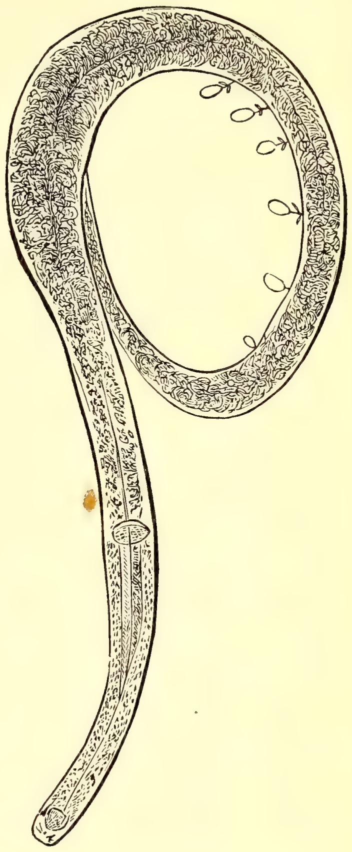
hole the size wanted is turned in C, and a saw cut or two are made as at D. This allows the hole in C to close, and after the article has been inserted, by screwing B on A, it may be held tightly. Little blocks like C are easily turned, and a few of them serve for a wide range of sizes.

—A novel Art College for Women has been established near Wimbledon, England, by Miss Bennett, a lady well known for the gratuitous instruction she has been in the habit of giving in art needlework. The course of study is thorough and comprehensive and the fees are moderate. The students will have the opportunity of getting renumerative employment, if needed.

Marvels of Pond Life—V.

ALTHOUGH the polyps are remarkable for the simplicity of their organization, they do not the less exhib' the wonderful nature of animal life. Their bodies are composed of the substance, called *sarcode*, in which is imbedded a coloring matter resembling that in the leaves of plants; every part possesses irritability and contractility, and they are very sensitive to the stimulus of light. The outer layer of their bodies is harder than the inner layer. These layers are severally called *ectoderm* and *endoderm*. They may be cut and grafted like trees, and if turned inside out, the new inside dig ests and assimilates as well as the old. Whether any form of consciousness can belong to creatures which have no distin ct nervous system is open to doubt, but it would seem probable from their movements that food and light afford them something like a pleasurable sensation in a very humble degree. If we were sufficiently acquainted with the secrets of molecular combination we might discover that the various functions of these simple organis ms were discharged by different *particles*, although it is only in higher creatures that muscular particles are aggregated into muscles, or nerve particles into nerves.

Having examined the general appearance and proceedings of the hydra, let us cut off a tentacle, or take a small specimen and gently crush it by pressing down the cover of the live box, and place the object so prepared under a power of about three hundred linear. If we then illuminate it with a moderate quantity of oblique light, we shall discover round the edge of the tentacle a number of small cells or capsules, from some of which a very slender wire or thread will be emitted.* These are the stinging organs of the polyp, and resemble those which Mr. Gosse has so ably elucidated in the sea anemones. Some writers have endeavored to show that they are not stinging organs at all, but so large an amount of evidence to the contrary is accumulated in Mr. Gosse's 'Actinologia Britannica,' that no reasonable doubt remains. The stinging capsules of the polyp are shown in the annexed sketch, and also the way in which they are employed, for it fortunately happened that on exposing one of the hydras to pressure in the live box, a small worm (*Anguillula*) escaped, which had been pierced with the minute weapons which are supposed to convey a poison into the wound. The authors of the 'Micrographic Dictionary' think that the prongs of the forks, which will be seen to point upwards in the sketch,* are springs, and occupy a reversed position in the capsule cells, and that their function is to throw out the threads. However this may



Anguillula pierced by stinging organs of the *Hydra viridis*. × 300.

be, the polyps, and similarly endowed creatures, have the power of darting out their poison threads with considerable force, and Mr. Gosse found that the anemone was able to pierce a thick piece of human skin.

The same excellent observer attributes the emission of the anemone poison threads, which he considers hollow, to the injection of a fluid. In their quiescent state, he thinks they are drawn in, like the finger of a glove, and are forced out as the liquid enters their slender tubes. Possibly the polyp stinging organs may have the same structure.

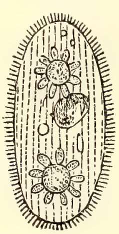
Notwithstanding their dangerous weapons, polyps are often infested with a

* See C and D, page 150, Dec., 1881.

parasite, the *Trichodina pediculus*, (which will be shown further on), and it must happen that either this visitation is not disagreeable, or that the Trichodina is not influenced by the poison.

As the plants in the bottles decayed, some of the animalcules died off and others appeared. In one bottle, containing decaying chara, *Paramecia* abounded. The *Paramecia,* of which there are various species, have always been favorite objects with microscopists. The Germans call them "slipper animalcules," and they vary in size from 1—96″* to 1—1150″. They are flat rounded-oblong creatures, with a distinct integument or skin, "through which numerous vibratile cilia pass in regular rows."† They are furnished with a distinct mouth, and adult specimens exhibit star-shaped contractile vesicles in great perfection.

The swarm of specimens before us belong to one species, *Paramecium aurelia,* the *Chrysalis animalcule,* and they crowd every portion of the little water-drop we have taken up, and examined with a power of about one hundred linear. When they are sufficiently quiet a power of about four hundred may be used with advantage, and Pritchard recommends adding a little indigo and carmine to the water, in order to see the cilia more clearly, or rather to render their action more plain. The cilia are disposed lengthwise, and Ehrenberg



Paramecium aurelia.

A dried specimen showing the vesicles.—*Pritchard.*

counted in some rows sixty or seventy of them, making an aggregate of three thousand six hundred and forty organs of motion in one small animated speck. This number seems large, but although we have never performed the feat of counting them, we should have expected it to prove much greater. Unlike most animalcules they are susceptible of being preserved by drying upon glass, and we subjoin a figure from Pritchard, of one thus treated, in which the star-shaped vesicles are clearly seen. These curious organs communicate with other vessels, and, as we have previously stated, are probably connected with respiration and excretion.

The genus *Paramecium* is now confined to those creatures which exhibit rows of longitudinal cilia of uniform length, which are destitute of hooks, styles, or other organs of motion than the cilia, which have a lateral mouth, and no eye-spots. One mode of increase is by division, which may be easily observed; another is through the formation of true eggs as traced by Balbiani.

Another of the treasures from the pond was a species of *Trachelius*, or long-necked ciliated animalcule, which kept darting in and out of a slimy den, attached to the leaf of a water-plant. The body was stout and fish-shaped, the tail blunt, and the neck furnished with long conspicuous cilia, which enabled the advancing and retreating movements to be made with great rapidity. The motions of this creature exhibit more appearance of purpose and design than is common with animalcules, but in proportion as these observations are prolonged, the student will be impressed with the difficulty of assuming that anything like a reasoning faculty and volition, is proved by movements that bear some resemblance to those of higher animals, whose cerebral capacities are beyond a doubt. It is, however, almost impossible to witness motions which are neither constant nor periodic, without fancying them to be dictated by some sort of intelligence. We must, nevertheless, be cautious, lest we allow ourselves to be deceived by reasoning so seductive, as the vital operations of the lowest organisms may be merely illustrations of blind obedience to stimuli, in which category we must reckon food, and until we arrive at forms of being which clearly possess a ganglionic system, we have no certainty that a real will exists, even of the simplest kind; and perhaps we must go still higher before we ought to believe in its presence.

Ehrenberg was much struck with the restless character of many infusoria—whether he looked at them by day or by night, they were never still. In fact their motions are like the involuntary actions which take place in the human frame; and if attached to their bodies we observe cilia that never sleep, the living membrane of some of our own organs, the nose, for example, is similarly ciliated, and keeps up a perpetual though unconscious work.

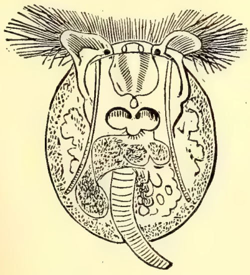
The *Paramecia* increase and multiply their kind without any fear lest the due adjustment between population and food should fail to be preserved. A small drop of the scum from the surface of the water in their bottle is an astounding sight. They move hither and thither in countless numbers, seldom jostling, although thick

* The usual mode of giving dimensions is by fractions thus expressed: 1—96″ means one ninety-sixth of an inch.

† 'Micrographic Dictionary.'

as herrings in a tub, and in many portions of the field the process of self-fissure, or multiplication by division, is going on without any symptoms of discomfort on the part of the parent creature. This is an interesting sight, but we will not linger over it, for the sun is shining, and there is enough warmth in the air to make it probable that the ponds will be more prolific than in the cold winter months. Sunshine is a great thing for the microscopic hunter; it brings swarms of creatures to the surface, and the Rotifers are especially fond of its genial beams. Even if we imitate it by a bright lamp, we shall attract crowds of live dancing specks to the illuminated side of a bottle, and may thus easily effect their capture by the dipping-tube.

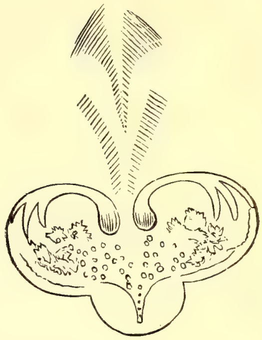
This year the March sunshine was not lost, for on the third of that month I obtained a bottleful of conferva from a pond about a mile from my house, and lying at the foot of the Highgate hills. Water-fleas were immediately discovered in abundance, together with some minute worms, and a ferocious-looking larva



Pterodina patina.

covered with scales; but what attracted most attention was a Rotifer, like a transparent animated soup-plate, from near the middle of which depended a tail, which swayed from side to side, as the creature swam along. The head exhibited two little red eyes; two tufts of cilia rowed the living disk through the water, and the gizzard worked with a rapid snapping motion, that left no doubt the ciliary whirlpools had brought home no slender stores of invisible food. Sometimes the end of the tail acted as a sucker, and fixed the animal tightly to the glass, when the wheels were protruded, and the body swayed to and fro. Then the sucker action ceased, and as the creature swam away, a tuft of cilia was thrust out from the extremity of the tail. A power of one hundred linear was sufficient to enable the general nature of this beautiful object to be observed, but to bring out the details, much greater amplification was required, and this would be useless if the little fidget could not be kept still.

The size of the creature, whose name we may as well mention was *Pterodina patina*, rendered this practicable, but required some care. The longest diameter of the body, which was not quite round, was about 1—120″, so that it was visible to



Pterodina patina—gizzard.

the naked eye, and as a good many were swimming together, one could be captured without much difficulty, and transferred with a very small drop of water to the live-box. Then the cover had to be put on so as to squeeze the animal just enough to keep it still without doing it any damage, or completely stopping its motions. This was a troublesome task, and often a little overpressure prevented its success.

Some observers always use in these cases an instrument called a *compressorium*, by which the amount of pressure is regulated by a lever or a fine screw; but whether the student possess one or not, he should learn to accomplish the same result by dexterously manipulating a well-made live-box. We will suppose the *Pterodina* successfully caged, and a power of about one hundred and fifty linear brought to bear upon her, for our specimen is of the "female persuasion." This will suffice to demonstrate the disposition and relation of the several parts, after which one of from four hundred to five hundred linear may be used with great advantage, though in this case the illumination must be carefully adjusted, and its intensity and obliquity frequently changed, until the best effect is obtained.

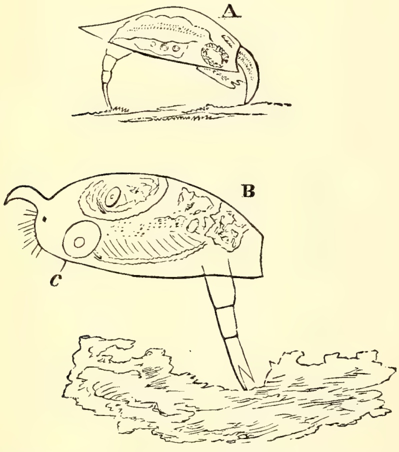
We find, on thus viewing the Pterodina, that it is a complex highly-organized creature, having its body protected by a *carapace*, like the shell of a tortoise, but as flexible as a sheet of white gelatine paper, which it resembles in appearance. Round the margin of this carapace are a number of little bosses or dots, which vary

in different individuals. The cilia are not disposed, as at first appeared, in two separate and distinct disks, but are continuous, as in the annexed sketch. Down each side are two long muscular bands,

Pterodina patina—tail foot.

distinctly *striated*, and when they contract, the ciliary apparatus is drawn in. As this contraction takes place, two apparently elastic bands, to which the ciliary lobes are attached, are bent downwards, till they look like the C springs behind a gentleman's carriage; and they regain their former position of slight curvature, when the cilia are again thrust out.

The gizzard is three-lobed, and curiously grasped by forked expansions of the handles of the hammers. The tail, or



A. Metopidia accuminata, as drawn by Mr. Gosse. B. Specimen as seen and described in text. *c.* Mouth or gizzard.

tail-foot, can be withdrawn or thrust out at the will of the creature; and when in a good position for observation, a slight additional pressure will keep it so for examination. Delicate muscular longitudinal bands, forked towards the end of their course, supply the means of performing some of its motions, and one, or perhaps two, spiral threads extend through the upper half of its length, and either act as muscles, or as elastic springs for its extension. The intestines and other viscera are clearly exhibited, and a strong ciliary action conducts the food to the gizzard-mouth.

To return to the tail. One spiral fibre is easily discovered; but I have often, and at an interval of months, seen the appearance of two, and am in some doubt whether this was a deception, arising from the compression employed, or was a genuine indication.

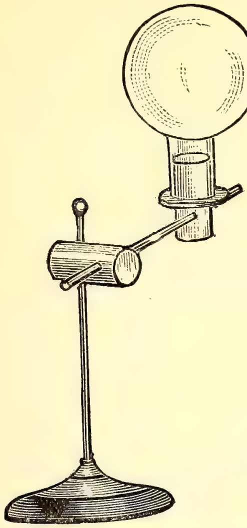
Where this Rotifer occurs I have usually found it plentiful, but unfortunately could obtain no constant supplies after I had determined to make a special study of the remarkable tail, which is much more complicated than I have described. The *Pterodina* lived for some time in captivity, and for a week or two I could obtain them from my glass tank. They were likewise to be found for some weeks in the same part of the pond, but not all over it, until one day not a single specimen could be discovered, notwithstanding a persevering search, nor was I afterwards able to get any from that pond during the remainder of the year.

Makeshifts for Young Microscopists.

IN the earlier numbers of the YOUNG SCIENTIST several simple pieces of microscopical apparatus were described, amongst others a very simple and effective substitute for the stage forceps, and a cheap bull's-eye condenser. I have lately made for myself several pieces of accessory apparatus, from which I get very good results, and it has occurred to me that it might be well to describe them for the benefit of my fellow readers. Amongst other pieces I have made a dark-ground illuminator which works very well, although it cost me actually nothing, except a little work, and a polariscope which cost me $2.50, and by which I get as beautiful effects as those produced by some of my friends who have paid $15 and $25 for their polariscopes. Of course in these estimates of cost I do not count my own time and labor, for I regard the making of these things as so much pleasant recreation.

One of the most useful accessories to the microscope is the bull's-eye condenser, as it is called. This consists of a lens of short focus and large diameter, which is used after the manner of a burning lens; that is to say, it is used to throw a bright

spot of light upon any opaque object that we wish to look at under the microscope. With the cheaper forms of the microscope



HOME-MADE CONDENSING LENS.

an opaque object which is illuminated only by ordinary daylight or lamplight, is hardly visible, but if we throw a beam of light on it by means of a condenser, it at once becomes visible, and such objects as seeds, shells, butterfly's scales, etc., seen in this way, are not only interesting, but really very beautiful. A short time ago, being on a visit to a friend's house, I found a young boy working with a cheap microscope, and trying to examine some portulacca seeds, which he had heard were very beautiful. Unfortunately, however, their beauties remained hidden, because they were literally kept in the dark. Rummaging amongst some odds and ends I found a small flask about an inch and a half in diameter. This I filled with glycerine, and then taking two corks and a darning needle I arranged the whole on an old paper file, as shown in the engarving. This little contrivance gave splendid results, and enabled me to bring out the beauties of quite a number of opaque objects, such as seeds, scales, feathers, etc.

In filling such a globe, I always use glycerine where I can get it. I do so because glycerine makes a stronger condenser, and also because in cold weather it does not freeze and burst the flask. O. W.

Cutting, Grinding and Engraving Glass—I.

TO ordinary persons, glass is a synonym for brittleness, and very few people ever think of it as an article that can be cut and worked like other materials. But those who have had a little experience find that glass is very easily shaped and finished, and as it is susceptible of taking a very high polish, its transparency and refractive powers give it a peculiar beauty which specially adapts it to the finer kinds of ornamental work. In former numbers we have told our readers how to cut it with a diamond or hot iron, and how to bore it with a steel drill, with emery, and with a diamond. We now propose to point out one or two other methods by which it may be worked up by the amateur for special purposes.

As a lid for an ornamental box, or a panel for a fancy cabinet, glass has peculiar fitness. In some cases it is bes when left perfectly transparent, so as to show the contents, as for example, where boxes are used for holding specimens of natural history. In this case good ordinary window glass may be used, and it is easy to cut the glass to fit the lid of the box and then fasten it in, after cutting out the material which it is to replace. A stout paste-board box with a plate of glass for a top, is exceedingly useful and convenient. But where the box is intended for ornament as well as for use, as for example, glove boxes and collar boxes, work boxes, etc., the glass may be beautifully ornamented by engraving it by means of the sand-blast, as will be explained in a succeeding article. Those who have had no experience in such work will be astonished how easily the most beautiful figures may be worked on glass by the sand-blast process, and the apparatus required is of the simplest kind, such as may be made by any one. Where glass panels are fitted to the doors of cabinets, such for example, as those used for holding microscopic objects, it is best to use heavy plate glass and

to bevel the edges. This is easily done if the proper tools are at hand. At first sight one would think that a good grindstone would be the best tool for grinding down the bevels of such a panel, but we have never found one that would answer even tolerably. Working glass on a grindstone is tedious, disagreeable work, and those who give much attention to glass-grinding will find it to their advantage to provide a suitable plate of cast iron or other metal. The plate should be round, and it should be mounted like a potter's wheel. In other words it should be fixed to the top of an upright spindle so that it may revolve horizontally, the glass being held against its upper surface. For such a purpose a cast iron plate is best and cheapest. It should be turned perfectly true, and the "skin" or hard outer scale of the casting should be entirely removed. When such a plate is fed with good sharp sand or emery, and is made to revolve rapidly, it cuts glass very fast. It takes but a few minutes to grind off the edge of a common tumbler so that it will be quite true, after which it may be used as a receiver for an air-pump. We have several glass vessels which were ground in this way, and which have proved very serviceable in experiments on gases, as they may be closed air-tight by means of a piece of plate glass and a little lard.

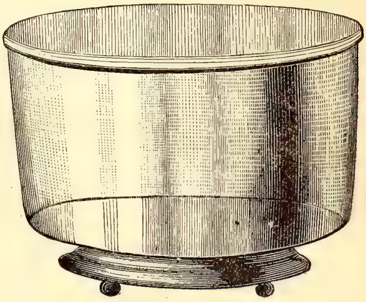
It is equally easy to grind off the edge of a thick glass plate so as to form a bevel on it, and since the great beauty of such a plate consists in its high polish and freedom from scratches, special care ought to be taken to prevent the sand or emery from acting upon the polished parts. This is best effected by pasting a piece of tough paper over the entire surface to be protected.

The grinding material consists of sand or emery and water, of which several grades of fineness should be provided. And as the muddy mixture flies off the plate as soon as the latter is set in motion, a hoop of paste-board, tin or zinc should be placed round the wheel or plate to catch it. The great objection to the operation is the dirt that it makes, but this is easily remedied by the use of an old apron or even a few newspapers, and any spots that may get on our clothes are easily brushed off when dry.

(To be continued.)

Taming Fishes.

PROCURE a large bell-glass—twenty inches in diameter—if you can get it. Such bell-glasses usually have a knob which prevents them from standing mouth up. Provide a block of wood with a large hole in it, or better still a stand like that shown in the figure; set it on a stand in a north window; lay down a bed of pebbles; plant a few tufts of water-weed (*Anacharis*), and fill with river water. After it has stood a few days, procure three small Prussian carp and six minnows. Have no gold-fish, no molluscs, and no rockwork. Allow the conferva to grow on the glass, except on the side next the room, which keep clean.



BELL-GLASS FOR AQUARIUM.

Every morning and evening feed the fishes with very small earthworms, gentles, or small caterpillars, and be careful to drop them in only one or two at a time, so that none be left to foul the water. Frequently sit beside the vessel, and watch the gambols of your pets; now and then tap on the front of the glass with your finger-nail, and so accustom them to your presence. By degrees they will get bold and playful; be sure to tap with your finger-nail before you feed them, and instead of dropping the food in for them to take it in their own way, hold a worm between your fingers at the surface, and one of the boldest of the minnows will snatch it away playfully. Persevere, and you may call them together by tapping on the glass, and have them feed from your fingers, and even submit to be tickled on the back in quiet enjoyment of your friendship and familiarity. H.

THE

Young Scientist.

A Practical Journal for Amateurs.

With which has been incorporated
"THE INDUSTRIAL MONTHLY,"
"THE TECHNOLOGIST," AND
"HOME ARTS."

PUBLISHED MONTHLY AT 50*cts. PER YEAR.*

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14 Dey Street, New York.

REMITTANCES.—Make all checks and postal orders payable to John Phin. U. S and English postage stamps received at full value for sums less than One Dollar. Canadian postage stamps are of no use to us, but Canadian silver and fractional currency will be received at full value.

Important Notice.

THIS number of the YOUNG SCIENTIST is sent as a sample to all our old subscsibers and to many who have never taken the journal. It is unnecessary for us to intimate that we would be glad to have all who see this number send us their subscriptions, but it may be well to say that no bills are sent out for the YOUNG SCIENTIST, and no credits given. When a subscription expires the journal is stopped. Our reason for this course lies in the simple fact that the price of the journal is so low that it is impossible for us to keep book accounts and send bills.

Who Wants a Rifle?

WE have a very fine little Flobert rifle, the bore of which has been rifled so that it shoots with great accuracy. (The ordinary Flobert rifles are all smooth bores.) It is just the thing for small game or target practice, and we will give it to the first that sends us a club of fifty subscribers to the YOUNG SCIENTIST. Remember, this weapon will be given to the first that completes a club of fifty ; after that, those who wish a rifle as a premium, will have to be satisfied with the ordinary weapon.

1882.—To Our Readers.

WITH this number the YOUNG SCIENTIST enters upon its fifth year. In noting the addition of another volume to the series, we cannot help acknowledging the appreciation which our efforts have received, and assuring our readers that their kind words and efforts have not passed unheeded by us. We could each month fill one or two pages with extracts from commendation letters that we have received, but we have always preferred to occupy our limited space with matter of more immediate value to our subscribers.

Our arrangements for 1882 are such that we feel assured that the fifth volume will be better than any that has preceded it. Prof. Wright will give us each month a series of interesting notes on astronomy. Mr. Hodgson will continue his thoroughly practical articles ; the "Marvels of Pond Life" will, as the summer advances, increase in interest and in the wonders which they develop; and we have engaged a series on the aquarium, the lathe, glass working, the voltaic battery, scientific experiments, etc. We hope also to be able to give the best series of articles on boat-building that has ever appeared. There are other interesting and important subjects in regard to which we have corresponded with writers who are able to give us good and popular articles. Amongst these is a monthly *resume* of the scientific progress of the world. Such a series might, we think, give our young people, and even some of our older ones, a valuable hint, at least of all the most important discoveries.

How far we shall be able to make the YOUNG SCIENTIST for 1882 equal to what we would like it to be, remains to be seen. We shall faithfully do our best, and we hope to receive aid from every one who has enjoyed reading our paper.

And now, reader, let us suggest a method by which you can aid us materially in the improvement of *your* journal and ours. It is simply by calling the attention of all your friends to the YOUNG SCIENTIST. If any of your numbers are injured by so lending or showing them, we will cheerfully replace them, and if

you can secure any subscriptions, our premium list affords a great variety of opportunities for procuring something that you want. The great obstacle in the way of the success of a small paper of the special character of the YOUNG SCIENTIST is the expense of advertising. Therefore, we must rely largely upon the kind offices of our readers to make the journal known to others. So much, then, for hopes and expectations for the coming year. In the hope that it will be a successful one for us and a pleasant one for you, we wish you

A MERRY CHRISTMAS AND A HAPPY NEW YEAR.

Bound Volumes for 1881.

WE have made special arrangements for binding the YOUNG SCIENTIST in a strong, neat and cheap manner. After the 20th of this month we will be able to supply bound volumes for 1881 for $1.00 each, or to bind the numbers of our subscribers for 35 cents each. This sum does not include postage where the volumes are sent by mail. Mailing costs 15 cents extra

BOOK NOTICES.

Lectures in a Workshop: By T. P. Pemberton, formerly Associate Editor of the "Technologist;" Author of "The Student's Illustrated Guide to Practical Draughting." With an appendix containing the famous papers by Whitworth "On Plane Metallic Surfaces or True Planes;" "On an Uniform System of Screw Threads;" "Address to the Institution of Mechanical Engineer's, Glasgow;" "On Standard Decimal Measures of Length." $1.00. New York: Industrial Publication Co.

The volume before us consists of a series of lectures and articles specially addressed to young mechanics. Several of these lectures were delivered before the Polytechnic Association of the American Institute, and were received with very great favor. The whole has been carefully revised and the unavoidable repetitions of an unconnected series having been cut out and other and more valuable points enlarged. The collection now torms a sprightly, fascinating book, full of valuable hints, interesting anecdotes and sharp sayings. It is not a compilation of dull sermons or dry mathematics, but a live, readable book. The papers by Whitworth, now first made accessible to the American reader, form the basis of our modern systems of accurate work.

The Boston Journal of Chemistry and Popular Science Review: Devoted to Chemistry, Pharmacy, Geology, Agriculture, Astronomy, Hygiene, Medicine, Practical Arts, Home Science, etc., etc. $1.00 per year. Boston: Journal of Chemistry Company,

This valuable journal has come to our desk regularly during the past year, and is always read with interest. It has recently enlarged somewhat the range of subjects which it discusses, and is now one of the very best exponents of general scientific progress. It gives brief notes of almost all scientific discoveries, and the care with which it is edited and the low price of its subscription commends it to those who wish to keep posted, but whose time for scientific study is limited.

The Builder and Wood Worker: A Journal of Industrial Arts. Published Monthly at 176 Broadway, New York. Chas. D, Lakey, Publisher. Fred. T. Hodgson, Editor.

The December number completes the seventeenth volume of this sterling periodical, which, under the able editorship of Mr. Hodgson, has now reached a circulation of which even sensational journals might be proud. The numbers which have reached us regularly during the year have been characterized by sound good sense, thorough knowledge of the arts which they discuss, and perfect ability to make matters clear to even the dullest workman. The illustrations, of which there is every month several full pages of detail drawings, are alone worth far more than the small price—$1.50—asked for the journal. Those who desire to club the *Builder and Wood Worker* with the YOUNG SCIENTIST can have both journals for $1.50.

Correspondence.

Protect the Birds.

Ed. Young Scientist—Now that the winter has arrived and the ground will soon be covered with snow, it would be a good idea for the readers of the YOUNG SCIENTIST and their friends, both boys and girls, to scatter food to the poor little birds, who are unable to obtain food for themselves; and I am sure any boy or girl who follows the above suggestion will be amply repaid at the end of winter to think that they may have saved the lives of the little birds, who will then reward them by their lively song. But while talking about protecting the birds, I would like to suggest that for the coming year (1882) a society should be formed called "The Society for the Protection of Birds." If this suggestion meets with the favor of the editor, I should like to hear from the boys and girls themselves through these columns.

ALEXANDER G. GIBBS.

Astronomy for Amateurs.

BY BERLIN H. WRIGHT.

(All calculations are for the Latitude of New York City.)

THE PLANETS FOR FEBRUARY, 1882.

MERCURY.

This planet arrives at eastern elongation on the 6th, and will be brightest from the 3d to 6th, being 18° 13′ from the sun. As he is east of the sun, he is, of course, an evening star and must be looked for after sunset and in the west. Being north of the sun, his altitude at sunset or at close of evening twilight will be such as to render him an easy object to pick up. On the 1st he sets at 6h. 39m. eve., 5° north of the sunset point; 5th, 6h. 52m. eve., and 7° north, and on the 10th at 6h. 55m. eve., and 8° north of the sunset point. The ⅄ which marks the northern limit of the constellation Aquarius, and through the centre of which the equator of the heavens passes, may be seen about 8° north of Mercury on the 5th. Venus is between Mercury and the sun, but so close to the latter that it is doubtful whether she can be seen at all, and there will be no body in the vicinity of Mercury for which he could be mistaken. The eye is at once attracted by the fiery red planet, so strikingly different from any other heavenly body.

VENUS.

Venus becomes an evening star on the 20th, when she is at superior conjunction. Some little time before that date she may be seen in the east just before sunrise, and afterwards in the west, after sunset. This sudden disappearance of Venus from the horizon and almost immediate reappearance on the opposite side of the earth, apparently 180° from where seen a few days since, was a great puzzle to the ancient astronomers.

MARS.

At 9 o'clock in the evening of the 1st, Mars passes the meridian, being situated in the Milky Way, and in the most interesting portion of the heavens. Betelguese is 20° south of him, and the 2d mag. star *Beta* Aurigae (7° E. of Capella) the same distance north; the Twins, with Castor and Pollux, upon the left; Procyon, Sirius, The "Kings" or "Stars of Orion's Belt," and Rigel, below or south of him; and Taurus, the Pleiades and Hyades, and *Beta* Tauri upon the right. He will be 5° north of the Moon on the 20th.

JUPITER.

Jupiter still remains the most attractive object in the evening sky. Though he and Saturn have the same apparent motion at present, it may be seen that the distance between them is gradually decreasing, owing to the greater motion in right Ascension of Jupiter. He sets as follows: 5th, 0h. 58m. morn.; 15th, 0h. 24m. morn.; 28th, 11h. 38m. eve., arrives at eastern quadrature (90° E. of Sun) on the 6th, and the Moon passes 2° south of him on the 23d.

FAVORABLE TIMES FOR OBSERVING THE PHENOMENA OF JUPITER'S SATELLITES.

(For an inverting telescope at 9h. 12m. eve., New York City Time.)

On the 9th all will be upon the east side of the planet, and very close together. This occurs again on the 16th, when they will be very much closer. On the 6th all that are visible will be upon the west side, but widely separated, II. being in transit, emerging one hour later; this occurs again on the 22d, except that I. and III. are close to each other, and the planet and II. are invisible, being in an eclipse.

The following are the visible eclipses which occur at seasonable hours:

	D.	H.	M.		
III.—	1	8	25	even.	Disappearance.
III.—	1	10	3	"	Reappearance.
I.—	7	6	19	"	"
II.—	8	7	10	"	"
I.—	14	8	15	"	"
II.—	15	9	46	"	"
I.—	21	10	11	"	"

SATURN.

The conspicuous reddish planet about 11° west of Jupiter is Saturn. His rings are in fair position to be seen, and the elevation of the earth above their plane will continue to increase until the latter part of August. The two largest of Saturn's satellites, Titan and Japetus, are easily seen with a telescope of 2-inch aperture, and these with the three next most conspicuous, Rhea, Dione, and Tethys, we have repeatedly seen with an instrument of 3-inch aperture. The following data will enable one to know where to look for these and to identify each, an inverting telescope being supposed to be used: Titan will be at western elongation on the 7th and 23d, and at eastern elongation on the 15th. Rhea, the next in order, is at eastern elongation on the 2d, 6th, 11th, 15th, 20th, and 24th. On the 15th this satellite will be in a line with Titan, and the planet. Dione is at E. elong. as follows: Feb. 1, 4, 7, 9, 12, 15, 17, 20, and 23. Tethys' eastern elongations are as follows: Feb. 2, 4, 6, 8, 10, 12, 14, 15, 17, 19, 21, 23, 25, and 26. Japetus will be at western elongation on the 20th. From the above data we find that on the 20th, for instance, Japetus will be far to the west of Saturn; Titan will be five days from E. elong., and hence about half way to its W. elong. and just north of the planet; Rhea will be at E. elong., and hence upon the opposite side from Japetus; Dione will be on same side

as Rhea and near it, and Tethys will be half way to its W. elong., and hence just north of Saturn and on a line between Titan and the planet.

APPEARANCE OF THE HEAVENS AT 9 P.M. FEBRUARY 15, 1882.

There is no season of the year when there is so grand a display of bright stars, interesting groups and constellations as at this time. Looking southward the eye beholds the richest portion of the heavens spread out before us, dazzling us for the moment by the great profusion of beautiful objects. No less than 30 first and second magnitude stars are in sight, presenting the finest spectacle the starry firmament affords.

Near the meridian and very near the southern horizon are the two bright stars Naos and Phaet, which form the southern termini of the legs of the "Great Egyptian X," which has Sirius for its centre and Procyon and Betelguese for the northern termini. The centre of the constellation Gemini is on the meridian, and the brightest stars, Castor and Pollux, are slightly east. Leo, the Lion, is the next conspicuous constellation eastward, the Sickle and Regulus marking the eastern boundary of Cancer. Virgo is just rising. West of the meridian the Hare, with the neat four-sided figure, is seen 20° south of the "Ell and Yard" or "The Kings," the three bright stars in the belt of Orion; Rigel is between them, but slightly to the right. Opposite the Kings from Rigel and nearly the same distance from them is Betelguese; 25° further north is *Beta* Aurigae, the 2d mag. star in the end of the horn of the Bull, and still about the same distance further north is Capella, 30° west of which is the "Segment of Perseus." Much nearer the western horizon are the Hyades and Pleiades.

THE COMETS OF 1881.

The astronomical discoveries of the year now drawing to a close have been mainly confined to that interesting and erratic class of heavenly bodies called comets. Seven of these visitors from afar off in space have, in their wanderings through the immensities of the stellar regions, passed through our system, and been telescopically visible over nearly the entire globe. Six of them are believed to be new comets, never before having visited us, or at least since scientific observations and records of such events have been made. Only two have been visible to the naked eye, and all of them have been discovered since May 1. At the time of the appearance of Comet 5, Encke's, five comets were telescopically visible—a very unusual, if not unparalleled event. In Feb., 1845, four were visible at once. Mentioned in the order of their discovery they are:

COMET 1 (A).—Discovered by Director Swift at Rochester, Warner Observatory, May 1; small and telescopic.

COMET 2 (B).—The Great Comet. The honor of first discovery in this country has, we believe, never yet been satisfactorily settled. Several hundreds have laid claim to such honor and to the Warner prize of $200. Probably first seen in the United States, June 23. This is without doubt the same comet that Dr. Gould observed at the National Observatory of the Argentine Republic, Cordova, June 1, and he suspected that it was the return of the comet of 1807. But although there were many points of coincidence in the elements of their orbits, later investigation showed very conclusively that they were distinct, and that Comet B had never before been with us. Quite satisfactory spectroscopic and photographic results were obtained from this comet by Dr. Draper and others, demonstrating, among other things, the material nature of the tails of comets.

COMET 3 (C).—Discovered by J. M. Schaeberle at Ann Arbor, Mich., July 13. First seen in the constellation Aurigae. Quite dim.

COMET 4 (D).—Discovered by E. E. Barnard, Nashville, Tenn., in the constellation Virgo, Sept. 19; telescopic.

COMET 5 (Encke's).—Director Swift, of Rochester, was the first to "pick up" this old acquaintance. It has the shortest period of any known comet; 3⅓ years; large telescopic.

COMET 6 (E).—Discovered simultaneously in Europe and America by Mr. Denning, of Bristol, Eng., and Mr. Brooks, of Phelps, N. Y. First seen in Leo, 3½° from Regulus. This is the only short-term periodical discovered this year, its period being 8⅓ years.

COMET 7 (F).—Discovered by Director Swift, of Warner Observatory, Rochester, N. Y., November 17. New and telescopic.

We would not be surprised if one or more cometary discoveries are announced before the close of the year. Eight were seen in 1858, the largest number in this country during a single year, we believe.

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS, FEB. 20, 1882.

	H.	M.	
Alpha Andromeda (Alpheratz) sets	9	51	even
Omicron Ceti (Mira) variable "	9	59	"
Beta Persei (Algol) variable, in meridian	5	0	"
Eta Tauri (Alcyone or Light of Pleiades) in merid.	5	40	"
Alpha Tauri (Aldebaran) in merid.	6	28	"
Alpha Aurigae (Capella) " "	7	7	"

	H.	*M.*	
Beta Orionis (Rigel) " "	7	8	even
Alpha Orionis (Betelguese) " "	7	48	"
Alpha Canis Majoris (Sirius or Dog Star) in merid.	8	39	"
Alpha Canis Minoris (Procyon) in meridian	9	32	"
Alpha Leonis (Regulus) rises	5	17	"
Alpha Virginis (Spica) "	9	54	"
Alpha Bootis (Arcturus) "	8	57	"
Alpha Scorpionis (Antares) rises	2	4	morn
Alpha Lyrae (Vega) "	11	37	even
Alpha Aquillae (Altair) sets	4	26	"
Alpha Cygni (Deneb) "	0	40	morn
Alpha Pisces Australis (Formalhaut) sets	4	50	even

Penn Yan, N. Y.

Practical Hints.

Ink for Stamping Celluloid.—A recent patent ink for writing or stamping celluloid consists of anilin color dissolved in carbolic acid, with ether or alcohol, or both. Ink so produced will not rub off celluloid goods.

Alcoholic Varnishes.—To make alcoholic lacquers or varnishes adhere more completely to polished metal surfaces 1 part boracic acid should be added to 200 parts of varnish. This composition will adhere so firmly and become so completely glazed as to be removed only with difficulty. Be careful not to add too much of the boracic acid, as it injures the gloss in that case.

Food for Tame Fishes.—Gold fish, minnows and vegetable feeders in general are very fond of boiled rice. They eat it greedily and thrive upon it. The rice is boiled in water until quite soft, then drained nearly dry, and, of course, given when quite cold. The boiled rice grains resemble grubs in appearance, and the fish make for them at once. One great advantage of boiled rice is that is has very little tendency to corrupt the waters. .

Soap Bubble Ballons.—M. Delon, of Paris, produces miniature balloons by means of ordinary gas conducted through a caoutchouc tube and clay pipe to glycerine soap solution. A small disk of thin paper, with fine wire from its centre to a little paper car with æronaut figures, is connected to the bubble when it begins to swell, the disk being attached by capillarity to the part where the drop forms. The detached bubble rises with its car.

How to Make Brass Springs.—Brass cannot be tempered in the manner in which steel is tempered. Hence, the only method to make a brass spring is to compress the metal either by rolls or by hammering. If the springs are to be flat, hammer them out to shape in thickness from soft wire, or sheet brass, somewhat thicker than the finished spring is to be. If the brass shows a tendency to crack in hammering, it must be annealed, which can be done by heating to a light red and plunging into water. In hammering use a light hammer, and don't spare the blows.

Ladies Shoe Dressing.—Extract of logwood, 2 ounces; bichromate of potassa, 2 drachms; yellow prussiate of potassa, 2 drachms; powdered borax, 3 ounces; water of ammonia, 2 ounces; shellac, 16 ounces; water, 1 gallon. Dissolve the extract in water, heating the liquid to nearly the boiling point. Then add the chromate and the prussiate of potassa. After a deep rich blue color has developed, add the borax, and when it has dissolved, the shellac, and lastly, the ammonia. Then keep the whole at a gentle heat, agitating the mixture with stick of wood, until the smell of ammonia has disappeared and the shellac has dissolved.

Hard Putty.—The *Carriage Monthly* gives the following for a hard putty that will dry in one day: Take the whitening, mash all the lumps out on the stone, and mix it into a stiff paste by adding equal parts of japan and rubbing varnish; then add as much keg-lead as you think will make it work free with the knife; then add the rest of the whitening until you have it to suit you. This will sand-paper good with one day's drying. If you want putty that will dry quicker, take dry white lead and mix with equal parts of japan and varnish, to which add a few drops of turpentine. This is very soft for putty, but can be sand-papered in from two to three hours, it becoming perfectly hard in that time.

Improvement in Corks.—Wood-topped corks have long been used, but are not so generally known as they deserve to be. The cork is provided with a cap of wood, which greatly facilitates its removal from a vial or bottle, and forms a very elegant finish. Owing to its breadth, the cap can be grasped in the same way that an ordinary "mushroom opener" is held, and sufficient torsion exerted to dislodge it without the necessity of resorting to a cork-screw. The cap is provided with a central vertical projection, which is glued fast in the centre of the cork, so that the latter must be destroyed before they can be separated. These caps are easily turned by amateurs, and for small cases of chemicals, blow-pipe reagents, etc., they are just the thing. The tops should be turned quite flat, so that a round label may be pasted on the top. This is very convenient when the bottles are kept in a box or drawer.

QUESTIONS AND ANSWERS.

Clay for Modeling.—I have been advised to mix the clay I use for modeling with glycerine, but I find it does not work well. The glycerine all "sweats" out, and besides that, after I get through I want the clay to dry and the glycerine prevents it from doing this. Is there any better remedy? Sculptor.

Ans.—Since water will not evaporate in an atmosphere that is saturated with watery vapor,

you can keep your clay from drying by placing it in a box lined with wet clothes, or you may lay moist clothes on the object, and over this place an oil-skin or rubber cloth. The difficulty is that the weight of the wet cloth is apt to press the object out of shape. Artists found out long ago that the glycerine recipe is a "sell," but our technical papers repeat the directions once a month at least, and our "books of recipes" faithfully copy them.

LIQUID FOR TEMPERING.—The following recipe was taken from ——— ———, a journal in which I have great confidence:—

To give iron a temper for cutting porphyry, make your iron red hot, and plunge it into water distilled from nettles, acanthus, and pilosella, or else in the juice pounded out from these plants. I have written to them for the common names of the plants, but have received no answer. Can you tell me? BLACKSMITH.

Ans.—We regret to be obliged to say that your confidence has been misplaced. The recipe is utterly worthless. As to the name of the plants, with the exception of the first, the author only gives one-half the name. This recipe is a very good sample of the thoughlessness of many of our scientific editors, who do not scrutinize closely the matter which they insert in their columns. The works of the older writers are filled with such trash, and men like Wendell Phillips tell us that if we could only find the proper name of the plant we would recover one of the lost arts.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business letters or cards they cannot be used.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

To exchange for a wood-turning lathe or offers, a Young America Self-inking Printing Press, with type and outfit complete; chase 3 x 5 inches. Embury McLean, 318 Bloomfield St., Hoboken, N. J.

What offers for "Our First Century," cost $7.00, bound in sheep, over 400 illustrations, 1,000 pages; also small Ruby Magic Lantern, cost $1.50. Box 217, So. Manchester, Conn.

Magic lantern, in good order, condensing lens, 2½ in. diameter, 8 slides. For small photographic camera or offers. H. A. Giddings, 4 Union Place, Classon Ave., Brooklyn.

Printing press, type, etc., worth $13, for offers. E. G. Vogeley, 1010 Bradford St., Pittsburgh, Pa.

Fifty canary birds, with and without crests; fancy poultry, conch shells, strombus alatus. For small printing press, books on natural history, or offers. Frank Lattin, Gaines, N. Y.

A good plain 7 shot revolver, 22 calibre, for a Students' inch or half-inch objective. Frank F. Colwell, Urbana, Ohio.

Wanted, Printing press and type, in good order, chase 6 x 10, or larger; will give hardware, tools, scroll saw, or designs. Chas. E. Little, 59 Fulton St., New York.

Photo outfit, tools, chemicals and apparatus, etc., etc.; wanted scientific books, apparatus, etc.; send lists. A. B. Campbell, Box 59, South Dayton, Catt. Co., N. Y.

Stuffed birds, insects or job printing (cards, labels, etc.) for mounted objects for the microscope. James P. Melzer, Milford, N. H.

A ring stand, filtering stand, calcium light jet and a gas holder, holding one cubic foot, for a phonograph. D. P. Smith, 59 Park Place, New York.

To exchange, Hugh Miller,s "Cruise of the Betsey," and "The Old Red Sandstone," cloth bound geological books, for lathe, hammock, or "Gray's Manual of Botany." Gus. C. Spaeth, Mt. Carmel, Ills.

F. F. F., Lock Box 83, St. Johnsbury, Vermont, would like to exchange or correspond with persons interested in mineralogy, Oology, philatology, Indian relics, books, entomology, numismatology, etc.

Wanted, a good printing press and type; state what is wanted in exchange. H. A. Kinney, Hamlin, Brown Co., Kansas.

I have a printing press and outfit (cost $15) to exchange for books, microscope, tent, watch, or offers. Henry E. Jacobs, 59 Harvard Street, Boston, Mass.

I have Vols. 2 and 3 of "Nests and Eggs of American Birds," to exchange for Vol. I of YOUNG SCIENTIST, or offers. N. B. Stone, Lock Box 9, Putnam, Conn.

Wanted, a printing outfit or offers, in exchange for baritone cornet, air gun, and other things, a list of which will be furnished upon application. E. S. Nixon, Jr., Box 345, Chattanooga, Tenn.

To exchange, minerals, ores, shells, papers, magazines, books, coins, stamps, for stamps, coins, minerals, stylographic pen, telephone, etc. A. M. Beveridge, P. O. Box 854, Appleton, Wis.

Will exchange minerals for other minerals; state what specimens you desire. E. A. Refsnyder, Phœnixville, Chester Co., Pa.

Wanted, a good powerful second-hand microscope; forward engraving of instrument, stating price, or what is wanted in exchange. L. D. Snook, Barrington, Yates Co., N. Y.

Wanted, botanical specimens of Western, West Coast, and Southern ferns, in exchange for Northern species; lists exchanged. H. N. Johnson, Coeymans, N. Y.

Wanted, copy of "Snowball's Elementary Natural Philosophy." M. B Tausy, Harrisburg, Pa.

A new 2 x 4 engine, worth $60, for a first-class bicycle; also a watch, revolver, and gas stove, for a 6 x 9 printing press, type, or offers. Geo. L. Lamson, La Fargeville, N. Y.

To exchange, specimens in botany, oology, etc., for those in other localities; botanical correspondents desired. Arthur Fairbanks, St. Johnsbury, Vt.

A German microscope, with 3 objectives and 5 eye-pieces, condensing lens, etc., resolving Pleurosigma angulatum, will be exchanged for a first-class spectroscope. Clarence L. Speyers, 50 West 17th St., New York.

Shells and Corals.—These beautiful objects form favorite parlor ornaments for the mantel-piece and the what-not, but under such circumstances they are generally looked upon as mere curiosities—" only this and nothing more." Mr. H. T. Woodman has taken a new departure in this direction, and has put up a number of boxes—none of which contain less than one hundred specimens—and which he sells for from 25 to 50 cents each. This gives not only a number of objects of great beauty, but a series of specimens, the examination and comparison of which cannot fail to afford much useful and interesting information. Our young friends who are at all interested in natural history cannot do better than to invest a few cents in one of these boxes. Mr. Woodman may be found at 23 Clinton Place, New York.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

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Cheap Lathes and How to Use Them.

BALLS and tops have always been favorite toys with boys, and no better exercise can be found for those who wish to begin lathe work than the making of a top for a younger brother or some little friend. It is not likely that the boy who makes the top will want to play with it, and this is so much the greater reason why a top should be chosen for a first effort, since the pleasure to be derived from making it will be trebled by seeing the pleasure it will give to another.

In order to be able to make a good top, the young turner must understand the method of using it and the points which render it good or bad. And this is true of every article made by human skill. He who works merely after a pattern without a thorough knowledge of the end to be attained will never achieve true success.

It is also necessary to take into consideration the character of the person who is to use it. Some little girls are very fond of spinning humming tops, while boys rarely care much for them. The favorite top amongst older boys is the kind known as the *peg top*, which is spun in the following way: A piece of fine whip cord is wound tightly round the conical part of the top which is then thrown to the ground in a manner well known to boys. The uncoiling of the cord causes the top to revolve or spin, and it continues to do so long after it has struck the ground. Part of the game of top-spinning consists in striking other tops so as to drive them out of a ring or even to split them, in which latter case the peg of the split top becomes the trophy of the one who split it. If tops are made too squat, with very short pegs, they are apt to "sleep"—that is to spin quietly and so offer a fair mark to the player who wishes to split them. On the other hand, tops with long pegs never stand still. They

keep constantly moving about and are very difficult to hit.

Tops are made of different varieties of wood, according to the kind of top and the person who is to use it. Thus, if the top is for a very little boy it may be of soft wood (pine or basswood) and shaped like the Spanish top which is shown in Fig. 1. This top is generally made of mahogany; it has not a peg, but instead of that it is furnished with a rounded knob at the lower end and it spins very quietly, consequently it may be used upon wooden floors and smooth pavements. Such a top is one of the easiest things to make, and very neat ones may be turned up in the simplest and cheapest kind of lathe. Peg tops are generally made of one of the harder kinds of wood, such as beech, maple, elm, apple, pear, mahogany, lignum vitæ or boxwood. Boxwood is said to make the best top; we are told that lignum vitæ answers admirably. Beginners, however, will find it difficult to work, and therefore we would recommend elm, pear, apple or dogwood as the best material for a first trial on a peg top.

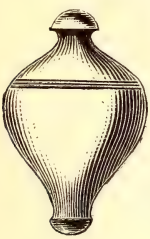


Fig. 1.

The peg should be of steel. Most of those which are sold are mere bits of iron wire. A few of the better class are of steel wire. Choice tops have a special forged steel peg, made conical and with a tang like that shown in Fig. 2.

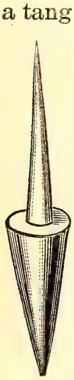


Fig. 2.

When well turned this makes a very fine peg. It cannot be driven into the wood so as to split the top, and the weight makes the top easy to throw. When a forged peg cannot be had, a very good one may be made out of a large bradawl which may be bought for a trifle in any hardware store. Soften it in the fire, cut off the round part to a length of about three-quarters of an inch, and file the square shoulders as round as you can. It is then ready to be driven into the wood. First of all, however, you ought to examine some good top, either in the stores or by borrowing it for a few minutes from the owner. In this way you will get a correct idea of the shape, etc., of the article you wish to make.

Having decided upon size and shape, procure a piece of good tough wood, close grained and well seasoned. Pare off the corners with a chisel or hatchet so as to make it nearly round. The object of this is to leave as little work for the gouge and chisel as possible. In the hands of an experienced turner, and with a good strong lathe, the corners can be ripped off with a gouge as quickly or even more quickly than with a hatchet. It is astonishing what an amount of wood can be cut off in a few seconds in the lathe when one knows how to do it, the great secret of success being a high speed, a sharp tool and a steady hand. For beginners, however, we would advise the removal of the corners by means of an axe or knife. The knife best suited to such purposes is the common draw knife with two handles. The wood is held in a vice or clamp, a circle is marked on each end with a pair of dividers, and the corners are carefully paired off to this circle. Those who have a small plane may use it and make the piece of wood very nearly quite round before putting it in the lathe. The wood is now ready for centering, and as this demands a consideration of the most suitable kind of lathe centre for such work, we will treat this point in our next article.

(To be continued.)

A Hanging Cabinet.

BY FRED. T. HODGSON.

THE proficient scroll-sawyer will no doubt, after a time become tired of making brackets, card-baskets, photo-frames and the thousand and one other useful and ornamental articles that are usually made up of work formed almost entirely by the aid of the scroll-saw. To give him an opportunity of trying his skill on something equally as useful, more durable, and perhaps just as handsome, I propose to show him how he can make a very nice "hanging cabinet."

To begin with, I present at Fig. 1 a

front view drawn to scale, and will try to describe it and give such instructions for its construction, that I think will make it

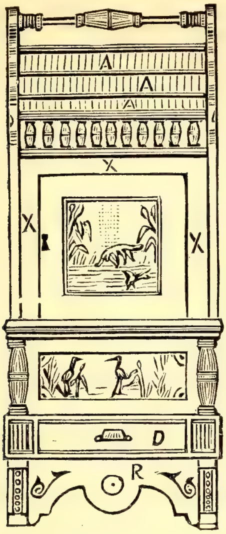


Fig. 1.

possible for any amateur fairly skilled in the use of tools, to make one as complete as the one shown in the engraving.

The actual example from which the engraving is taken is made of cherry ebonized, and is extremely pretty; I would therefore suggest that cherry be used for making the one now under consideration. To this end it will require two pieces for sides, about 9 inches wide, and 2 feet 8 inches long, and 1 inch thick. About three feet superficial measure and 1 inch thick for a panel door, front casings X X X, front of drawer D, and top A A A. The shelf over the drawer, the bottom of the cabinet, the slide under the drawer, and the double bracket R under the drawer may be made of cherry five-eighths, nalf inch, or three-eighths thick. The outsides of the drawer should be made of stuff 2 inches thick, and have small panel on the end of each one as shown on the front view. The door is framed together like any ordinary panel door, and the ornamental panel in the centre is simply a single Minton tile, or where the tiles cannot be obtained a plain pine panel may be substituted, and hand-painted, or plate or stained glass may be used, but when tiles are used a much better effect is produced. The panel in the back, just above the drawer, may be hand-painted or otherwise ornamented.

The double bracket R, and the circular brackets at the lower ends of the sides, may easily be cut out by aid of a scroll saw, so also may the side brackets above the drawer and the ornaments on the top of the sides.

Fig. 2 shows a scale by which all the

Fig. 2.

measurements in the engravings, Figures 1 and 3, may be taken. The small divisions represent inches, and the largest divisions represent feet. It will be seen that by using this scale any part of the design may be measured accurately and transposed to actual inches and feet.

The ornaments shown on R and on the side, Fig. 3, are incised or cut into the

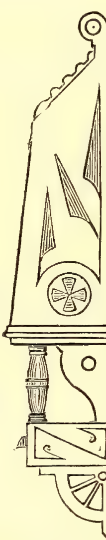


Fig. 3.

wood about a quarter of an inch deep, and the widest incisions, like the Maltese cross and the lance-head ornaments, should be embossed. This can be done with punches, but where these are not avail-

able, a blunt pointed nail will do very fair work. The incised work wants to be done very carefully. And where it consists of narrow channels only, care must be taken to have the groves of parallel width. When done well, this style of work has a good effect. After the cabinet is complete, ebonized and finished up, the incised work might be touched up, or, as finishers say—pricked in with gold. A very few sheets of gold leaf will do this, or where this cannot be done, liquid gold may be applied with a fine brush.

The top rail should be turned out of a piece of cherry 2x2 inches, the exact length between its shoulders must be the same as the distance between the sides of the cabinet. The two small columns between the drawer and the cabinet shelf are turned out of stuff 1½x1½ inches thick, and are fastened at both ends with pins that are left in the ends of columns and go into holes bored into the shelves. The ribbon moulding that runs around the front and the two sides, over the two small columns, is glued and nailed on with small nails where heads must be sunk below the surface of the wood.

The cover A A A is made of stuff 1 inch thick, and is cut to look like shingles. To make this is a very simple matter, as will easily be seen by a close inspection.

The drawer requires the front to be made of cherry, but the sides, end and bottom may be made of pine or any other soft wood. Where it can be done, it is better to dove-tail the drawer, but where this cannot be done, halfing the pieces together will answer the purpose. The pull on the drawer is made of wood, but where brass or nickel plated goods can be obtained it would be better to have a brass or nickel plated drop handle. The door should also be trimmed and hung with brass or nickel plated hardware.

Fig. 3 shows a side view of the cabinet. It will be noticed that the top end is somewhat narrower than the bottom, this necessarily makes the door on an incline which insures its closing after using.

Fig. 4 shows the turned balusters on the top of cabinet in front. It also shows the style of moulding used for rail and base piece of balusters. The dotted lines show the pins on the end of balusters by which they are fastened into the rail and base piece. These are drawn to full size.

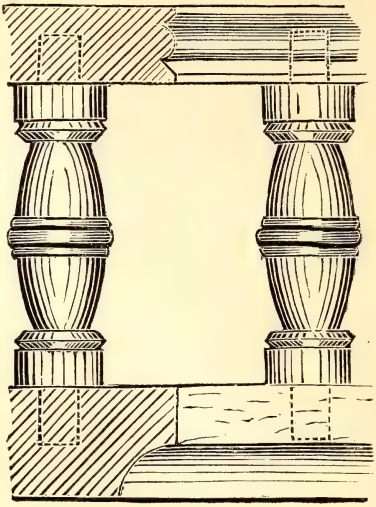


Fig. 4.

Fig. 5 shows a perspective view of the cabinet complete. This is presented so that the amateur worker will have a better

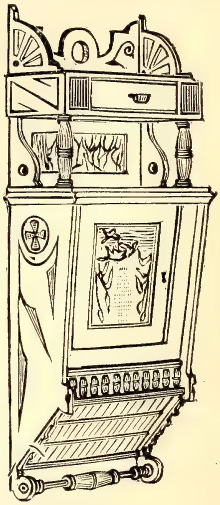


Fig. 5.

idea of the manner in which the work is put together.

Good glue, fine brads and care are all that is necessary to put the work together after it has all been gotten out properly.

Recipes for ebonizing are quite numerous, and one or two good ones can be found in back numbers of the YOUNG SCIENTIST, which, if closely followed, will give good satisfaction.

In conclusion, let me say that I will be happy to aid any of my young readers who may wish to make one of these cabinets, if they will acquaint me of their wants either through these pages cr in care of the editor.

The Aquarium.—New Mode of Aerating the Water.

SO important do we regard the subject of the aeration of water that we shall endeavor to present it to our readers in another way. Let us suppose a tank holding 12½ gallons of water or 100 pints. This amount of water would at the freezing point hold in solution—

Of nitrogen, ...	2 pints
" oxygen, ...	4 "
" carbonic acid, . .	179 "

But when the temperature of the water rises to 60° Fahr., these quantities are reduced to the following:

Nitrogen, ...	1.4 pints
Oxygen, ...	3 "
Carbonic acid, .	100 "

The pressure is assumed to be the ordinary pressure of the atmosphere. The quantity of gas absorbed increases with the pressure, as we see in the case of ordinary soda water, when a large quantity of carbonic acid is forced into the water by pressure, and remains quietly dissolved until this pressure is removed, when it at once escapes, causing a strong effervescence. The common "siphon" bottles show this very well.

The fact that as the temperature rises the gas which is dissolved in the water tends to escape, is well illustrated by a tumbler of common well water freshly drawn. Such water is generally cold; if brought into a warm room it at once gives off a large amount of gas, which appears as bubbles adhering to the sides of the tumbler.

So much for the capability of water to absorb gas. We now pass to a consideration of the conditions under which gas will be absorbed. It is evident that if no change is going on in the water, that is to say, if no plants or animals are present to absorb one kind of gas and give off another, any body of water will soon become saturated with air and will remain so. But if animals are present to use up the oxygen, and there are no plants to furnish a fresh supply, it will be found that the rapidity with which the water absorbs oxygen is exactly proportioned to the extent of surface exposed. Hence the practical conclusion that we must *spread out* the water of an aquarium if we would have it thoroughly aerated without the aid of plant life. And as in most aquaria the animals are kept in excess, it happens that those who have tanks which expose a large surface to the air, in proportion to the quantity of water present, generally have the best success. There are other conditions, however, which enter into this question, and which confer certain advantages on *deep* aquaria, and these we will consider hereafter. Meanwhile let it be understood that where water is aerated either by mere exposure or by mechanical means, everything depends upon the extent of surface which is exposed. Therefore, if you have gold fish in a glass globe, do not fill it too full. As soon as the water rises above the middle of the globe, the water surface diminishes, and the fish feel the want of air. No vessel of a globular shape should ever be filled more than two-thirds full.

When air is pumped into water, as was done in Barnum's old museum and in the tanks of the New York Aquarium, now also defunct, it will not do to pass the air into the water from the end of an open pipe, as is generally done. In this case the air passes through the water in large bubbles which expose very little surface in proportion to the amount of air that they contain, and consequently very little air is absorbed. Moreover, a large bubble ascends through the water more rapidly than a small one, and consequently time enough for absorption is not allowed. Some have sought to remedy this by a piece of wire gauze over the end of the pipe, but this does not answer, as, after passing through the gauze, the several

streams into which the meshes divide the air, unite and again form large bubbles. The true way is to allow the air to escape along the bottom of the tank from a series of fine holes bored in the pipe at a considerable distance from each other.

When the water in an aquarium needs aerating, and there is no contrivance provided of the kind we have just described, the best plan is to dip out some of the water and pour it back in a very fine stream. This is, however, rather tedious, and the temptation becomes very strong to allow the stream to get large and strong. Such a stream not only fails to accomplish the object in view, but it produces in the tank a commotion, which is very apt to do damage. Experience having taught us the objections to the ordinary plan, and all ordinary aquaria requiring a little occasional mechanical aeration, we devised the following method which we have found in practice to answer admirably. Make a bundle of straight, sound and clean straws about 12 to 18 inches long and two inches or more in diameter. Tie them firmly but not tightly together, and hold them slightly sloping, and with the lower end dipping in the water of the tank. Pour the water on the bundle of straw as near the top as possible, and allow it to flow down the bundle into the tank. Each straw and each space between the straws, acts as a Sprengel pump, or the blast of a Catalan forge; and not only is the water that is poured in thoroughly saturated with air, but a series of very minute bubbles are carried far down into the tank, serving to oxygenate the entire body of water. Two or three pitchers full poured into the tank in this way will make the water sparkling and pleasant.

Cheap and Useful.

WE find that we have on hand a few copies of the *first* edition of the "Amateur's Handbook of Practical Information for the Laboratory and the Workshop." It contains quite a large number of useful recipes and directions for mechanical processes. In order to close out the remainder of this edition, we will send a copy to any address, on receipt of seven cents in postage stamps.

Make Shifts for Young Microscopists.

ONE of our most common proverbs is that "accidents will happen," and unfortunately its truth is too frequently proved. Some time ago a young friend of mine broke the mirror of his microscope, and, of course, sent it some distance to an optician to have it replaced. While it was gone his microscope was laid aside as useless, although he was very anxious to examine some new slides and some fresh collections that he had made. Now came the time for a make shift.

I took a thin piece of fine grained wood (less than a quarter of an inch thick) and on it described a circle of the same diameter as the brass frame in which the mirror was mounted. This wood was then cut away so as to leave a thin circular disc which could be easily placed in the mirror-holder and could be adjusted to any angle. To one side of the disc I fastened a bit of looking glass, and the other side I covered with the whitest, clearest, paper I could find. Common paste answered very well to fasten both, and the microscope was again in good condition.

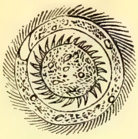
When examining a large object with a low power we used the white paper and this answered better than any mirror, as it gave a softer and more even illumination. For ordinary objects the bit of looking glass answered very well either by daylight or lamplight, but when a stronger light was needed in the evening, by lamplight, it was an easy matter to concentrate the light of the lamp by means of the bull's eye condenser, and this gave all the effect of a concave mirror.

And, by the way, let me here advise those readers of the YOUNG SCIENTIST who have microscopes with condensing lenses *attached*, to at once provide a separate stand for the lens. It is easily done by means of a common upright letter file and a bit of wood or even a cork, somewhat after the manner dercribed in the YOUNG SCIENTIST, vol. 1, page 70. A lens thus mounted is not only more easily applied to the illumination of opaque objects, but it can be used for other important purposes for which it cannot be employed when it is a fixture.

O. W.

Marvels of Pond Life—VI.

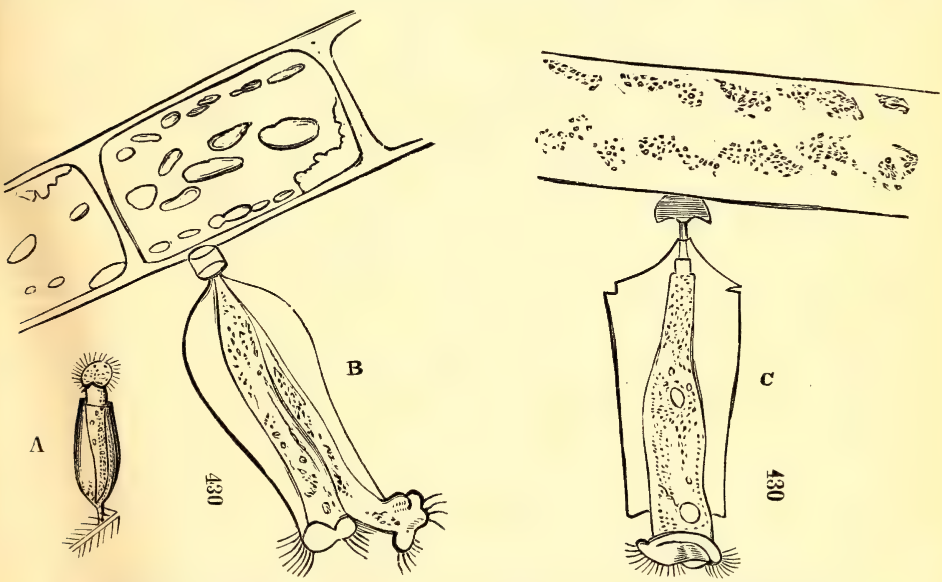
SEVERAL other Rotifers, with and without carapaces, were among the same* mass of confervæ, among them a *Metopidia*, with a firm shell, a forked jointed tail, and a projection in front which worked like a



Trichodina pediculus.

pickaxe among the decaying weed. There were likewise specimens of the long-necked animalcules (Trachelii), groups of Vorticella, some specimens of Volvox, and a small *Trichodina pediculus*, which, when magnified two hundred and sixty linear, was about the size of a sixpence and equally round. The edge was beautifully fringed with a circle of cilia; in an "Tenby," and described as the "Yellow Philodine," but this must remain in doubt, as it managed to escape before it could be secured.

By the 18th of the month the Vorticellids were much more plentiful, and their changes easily watched; many left their stalks while under the microscope, after which some rushed about like animated and demented hats, others twirled round like tee-to-tums, while others took a rest before commencing their wild career. But the common Vorticellæ were not the only or the most interesting representations of their charming order, for upon some threads of conferva were descried several elegant crystal vases standing upon short foot-stalks, and containing little creatures that jumped up and down like "Jack in the box." These were so minute, that a power of four hundred and thirty linear was advantageously brought to bear upon them. When elongated their bodies were somewhat pear-shaped, but more slender, and variegated with vacuoles and particles



A. Cothurnia imberbis—(Micrograph. Dict.') B and C. The specimens described in text.
The figures give the *linear* magnification.

inner circle was a row of locomotive organs, and the centre exhibited vacuoles constantly opening and shutting. This creature, as before explained, is often found as a parasite upon the polyps. On one occasion a glimpse was caught of a Rotifer similar in shape to the common wheel animalcule, but with a yellow inside. Possibly it was the object so beautifully delineated by Mr. Gosse, in his

* Figured in our January number.

of food. The mouths resembled those of Vorticellæ, and put forth circles of vibrating cilia. They were easily alarmed, when the cilia were retracted, and down they sank to the bottom of their vases, quickly to rise again. In one bottle there were two living in friendly juxtaposition. This was not a case of matrimonial felicity, nor of Siamese twins, but of *fission*, or reproduction by division. The original inhabitant of the tube finding himself too fat, or impelled by causes we do not

understand, quietly divided himself in two, and as the house was big enough, no enlargement was required. How many stout puffy gentlemen must envy this process; how convenient to have two thin lively specimens of humanity made out of one too obese for locomotion. Man is, however, sometimes the victim of his superior organization, and no process of "fission" can make the lusty lean.*

The bottles in which these creatures live, in happy ignorance that they are called by so crackjaw a name as *Cothurnia imberbis*, were described as *Carapaces* by Ehrenberg, but they bear no resemblance to the shell of a turtle or crab. They are thrown off by the animals who preserve no other connection with them than the attachment at the bottom.

The Micrographic Dictionary describes the family Ophrydinaas corresponding to Vorticellina with a carapace. Stein places them with Vorticellids, etc., amongst his Peritricha, which are characterized by a spiral wreath of cilia round the mouth.

Towards the end of the month a great number of black pear-shaped bodies (Stentor niger), visible to the naked eye, were conspicuous in some water from the Kentish Town ponds. Upon examination they were found to be filled with granules that were red by reflected, and purple by transmitted light. Each one had a spiral wreath of cilia, with a mouth situated like those of the stentors, hereafter to be described, but none of them became stationary, and in a few days they all disappeared. Stein divides Ehrenberg's Stentor igneus from S. niger; the creature described seem to have agreed with Stein's *igneus*, which he describes as having blood-red, lilac, cinnabar, or brown-red pigment particles, and as much smaller than his S. niger. In the same water were specimens of that singular Rotifer, the *Salpina*, about 1—150″ long, and furnished with a *lorica*, or carapace, resembling a three-sided glass box, closed below, and slightly open along the back. At the top of this box were four, and at the bottom three, points or horns, and the creature had one eye and a forked tail. Keeping him company was another little Rotifer, named after its appearance, *Monocerca rattus*, the 'One-tailed Rat.' This little animal had green matter in its stomach, which was in constant commotion. I ought to have observed that the Salpina repeatedly thrust out its gizzard, and used it as an external mouth. In the annexed sketch the Salpina is seen in a position that displays the dorsal opening of the carapace. Its three-cornered shape is only shown by a side view.

Salpina redunca.

Few living creatures deserve so well the appellation of "beautiful" as the *Floscularia ornata*, or Beautiful Floscule, although to contemplate a motionless and uncolored portrait, one would imagine that it exhibited no graces of either color or form. Mr. Gosse has, however, done it justice, and the drawing in his "Tenby" is executed with that rare combination of scientific accuracy and artistic skill, for which the productions of his pencil are renowned.

Probably the sketches in several works of authority representing the long cilia as short bristles, are merely copies from old drawings, from objects imperfectly seen under indifferent microscopes, and before the refinements of illumination were understood. Be this as it may, any reader will be fortunate if on an April, or any other morning, he or she effects the capture of one of these exquisite objects, although the first impression may not equal previous expectations, as the delicacy of the organism is not disclosed by a mode of using the light which answers well enough for the common infusoria.

When the Floscules, or other tubicolar Rotifers are specially sought for, the best way is to proceed to a pond where slender-leaved water-plants grow, and to examine a few branches at a time in a phial of water with a pocket-lens. They are all large enough to be discerned, if present, in this manner, and as soon as one is found, others may be expected, either in the same or in adjacent parts of the pond, for they are gregarious in their habits. With many, however, the first finding of a Floscule will be an accident, as was the case last April, when a small piece of myriophyllum was placed in the live-box, and looked over to see what it might contain. The first glimpse revealed an egg-shaped object, of a brownish tint, stretching itself upon a stalk, and showing some

* Balbiani in his 'Recherches sur les Phenomenes Sexuels des Infusoires.' speaks of the Vorticellids as the only Infusoria dividing longitudinally. In other species such appearances arise from conjunction.

symptoms of hairs or cilia at its head. This was enough to indicate the nature of the creature, and to show the necessity for a careful management of the light, which being adjusted obliquely, gave quite a new character to the scene. The dirty brown hue disappeared, and was replaced by brilliant colors; while the hairs, instead of appearing few and short, were found to be extremely numerous, very long, and glistening like delicate threads of spun glass.

Knowing that the Floscules live in transparent gelatinous tubes, such an object was carefully looked for, but in this instance, as is not uncommon, it was perfectly free from extraneous matter, and possessed nearly the same refractive power as the water, so that displaying it to advantage required some little trouble in the way of careful focusing, and many experiments as to the best angle at which the mirror should be turned to direct the light. When all was accomplished, it was seen that the Floscule had her abode in a clear transparent cylinder, like a thin confectioner's jar, which she did not touch except at the bottom, to which her foot was attached. Lying aside her in the bottle were three large eggs, and the slightest shock given to the table, induced her to draw back in evident alarm. Immediately afterwards she slowly protruded a dense bunch of the fine long hairs, which quivered in the light, and shone with a delicate bluish-green lustre, here and there varied by opaline tints.

The hairs were thrust out in a mass, somewhat after the mode in which the old-fashioned telescope hearth-brooms were made to put forth their bristles. As soon as they were completely everted, together with the upper portion of the Floscule, six lobes gradually separated, causing the hairs to fall on all sides in a graceful shower, and when the process was complete, they remained perfectly motionless, in six hollow fan-shaped tufts, one being attached to each lobe. Some internal ciliary action, quite distinct from the hairs, and which has never been precisely understood, caused gentle currents to flow towards the mouth in the middle of the lobes, and from the motion of the gizzard, imperfectly seen through the integument, and from the rapid filling of the stomach with particles of all hues, it was plain that captivity had not destroyed the Floscule's appetite, and that the drop of water in the live-box contained a good supply of food.

Sometimes the particles swallowed were too small to be discerned, although their aggregate effect was visible; but often a monad or larger object was ingulfed, but without any ciliary action being visible to account for the journey they were evidently compelled to perform. The long hairs took no part whatever in the foraging process, and as they do not either provide victuals or minister to locomotion, they are clearly not, as was supposed by early observers, representatives of the "wheels," which the ordinary Rotifers present. Neither can the cylindrical jar or bottle be justly deemed to occupy the position of the lorica, or carapace which we have before described. The general structure of the creature and the nature of its gizzard distinctly marked it out as a member of the family we call "Rotifers," but the absence of anything like "wheels" proves that those organs are not essential characteristics of this class.

Boring Wooden Handles.

Where many handles are to be bored, a half round bit, or a short piece broken off a carpenter's nose-bit and soldered into a small brass chuck to fit into the centre hole of the poppet head would be a good way of starting the holes. The handles should be held either in a clamp chuck or supported by a collar plate. I always use a common gimlet, taking care, however, not to work it as you would a cork-screw, viz., holding the bottle still and turning the screw round, but holding the gimlet firmly in the right hand and letting the tool handle shift at each half turn in the left hand as by this means you can feel whether it is running straight down the middle or not, and with a common gimlet you can apply force sideways to scoop the hole when you find any tendency to running out. The usual way is to burn the tools into their handles, and I see no objection to the practice, provided first the hole has been bored deeper than the point of the tang of the tool will go; and secondly, that all the charred portion of the wood is filed or scraped out of the hole before finally driving the tool in.

A much better plan is to have two or three floats or taper files cut on one side and one edge only with a few coarse teeth, and one or all made to cut backwards, for getting out the holes to suit the different dimensions of tangs. Almost any old tool that is small enough will do to make them of, and the notches may be and are better for being as uneven as you please; and the tool need not be hardened, or if hardened should be lowered to saw temper so that you can easily sharpen it with a file. The best wood for handles is ash, as it does not blister the hands. It must be well seasoned or the ferrules will drop off, and a dressing of linseed oil and yellow ochre, with alkanet root to give a red tinge, should be smeared on and allowed to dry on for a day or two before giving the finishing rub off.—*English Mechanic.*

THE

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14 Dey Street, New York.

REMITTANCES.—Make all checks and postal orders payable to John Phin. U. S and English postage stamps received at full value for sums less than One Dollar. Canadian postage stamps are of no use to us, but Canadian silver and fractional currency will be received at full value.

Bills.

MANY of our subscribers complain that we stop their journals without due notification, and that if they were reminded of the expiration of their subscriptions they would at once remit. To remove all cause of dissatisfaction on this score we have printed little pink bills which were enclosed in the January number to all whose subscriptions expired. If you wish to renew, just write your name and address distinctly in the blank space left for this purpose and enclose it to us with fifty cents, which may be in postage stamps. The receipted bill will be enclosed in the following number of the YOUNG SCIENTIST.

Postage Stamps.

WE again call the attention of our subscribers to the fact, that while we take postage stamps of small denominations at full value, those of higher denominations are of no use whatever to us. We cannot sell them, except at a very great loss, and the post office will not exchange them for smaller denominations. Therefore, please do not send them.

Scientific Blunders.

A STRIKING illustration of the superficial character of the men who contribute "scientific" articles to the popular magazines occurs in a recent article on the telegraph in *Harper's Magazine.* The writer of this article illustrates his subject by water flowing through a pipe of three inches in diameter, which at a certain point forks into two branches, one being two inches and the other one inch in diameter. He gravely informs his readers that it is clear that the stream will divide at the branches, *one-third* passing through the smaller pipe and *two-thirds* through the larger one. If the scientific writer had consulted a table of areas, he would have found that the two inch pipe has four times the area of the one inch pipe, and consequently, one-fifth the volume of water (instead of one-third) will flow through the smaller pipe and four fifths through the two inch pipe. The writer in question seems to be about as ignorant of such matters as the owner of a certain stream who sold to a manufacturing company a supply of water regulated by a pipe of a certain diameter. In process of time the company found that they needed more water so they made a bargain with the owner whereby they were allowed to use a pipe of double the diameter by paying double the price. The owner of the stream did not know that a pipe of double the diameter would allow four times the amount of water to pass throught it, and consequently his ignorance of geometry resulted to him in an actual loss of dollars and cents.

Who Wants a Rifle?

WE have a very fine little Flobert rifle, the bore of which has been rifled so that it shoots with great accuracy. (The ordinary Flobert rifles are all smooth bores.) It is just the thing for small game or target practice, and we will give it to the first that sends us a club of fifty subscribers to the YOUNG SCIENTIST. Remember, this weapon will be given to the first that completes a club of fifty ; after that, those who wish a rifle as a premium, will have to be satisfied with the ordinary weapon.

Exchanges.

WE would again call the special attention of our subscribers to the very reasonable rules which we have laid down in the matter of exchanges. Some of our friends think that we ought occasionally to relax the rigor of these rules for their especial benefit. To such we can only say that if we change the rule for one we must do it for all. We would much rather give a subscriber free space in our advertising columns than break through our rules in regard to exchanges. So if your exchange has not appeared, just sit down again with the rules before you and write it out in conformity with them.

BOOK NOTICES.

Easy Experiments in Chemistry and Natural Philosophy. For Educational Institutions of all Grades and for Private Students. By G. Dallas Lind, author of "Methods of Teaching in Country Schools," etc. Price, 40 cents. New York: Industrial Publication Co.

The author of this work tells us in his preface that he "has spent much time in studying the art of illustrating the subjects of Chemistry and Natural Philosophy by means of simple and cheap apparatus." After a careful examination we feel no hesitation in saying that the result is very satisfactory. By the use of such simple things as ordinary bottles and preserve jars, the *use* at least of which may be obtained at almost any time for little or nothing; of corks, wires, and similar odds and ends, he shows how to perform a great many very instructive, interesting, and beautiful experiments. In many cases he uses very common and simple things for articles which are more elegant and convenient, if not more efficient. Thus for tubes he suggests the use of elder-stems; old cans, such as are used for preserving meats, oysters, etc., are frequently brought into play. It is really astonishing to see how much may be accomplished by means of such simple materials and a little ingenuity. An important feature of the book is the fact that the explanations are all scientifically accurate. To the teacher it will prove a means of enlivening many an otherwise dull recitation, while to the self-taught student it will be a source of endless amusement and pleasure.

The Phrenological Journal. S. R. Wells & Co., 753 Broadway, New York.

Whatever may be said about the special principles or theories advocated by this journal, it is an unquestionable fact that aside from such matters the subscribers get a full equivalent in the sprightly biographies and general articles which the journal contains. The tendency of the Phrenological Journal has always been towards purity and correct morality, and it should be a welcome visitor to every home.

Ward's Natural Science Bulletin.

This is a new candidate for favor, and one for which we predict a very great success. Prof. Ward is well known as the possessor of the largest commercial collection of really good minerals, fossils, and objects of natural history in general on this continent, and it therefore follows that material and means are at hand to make a good journal. Numbers 1 and 2 are before us, and they certainly promise well. Filled with able and interesting original articles, they are of great value to young people who are fond of collecting, and who wish to understand the scientific relations of the things they collect. The practical character of the contributions to this journal will be appreciated by those who read the article on Bird Skins, which we have transferred to another column.

The *Bulletin* is issued quarterly at the rate of fifty cents per year. It is printed in fine clear type on excellent paper, and we hope to make favorable arrangements for clubbing it with the YOUNG SCIENTIST.

Astronomy for Amateurs.

BY BERLIN H. WRIGHT.

(All calculations are for the Latitude of New York City.)

THE PLANETS FOR MARCH, 1882.

MERCURY.

This month Mercury may be seen in the east, before sunrise, as a morning star. He attains his greatest angular distance west of the Sun on the 21st, and accordingly is brightest from the 20th to 25th. This will not be as favorable an opportunity to see him as last month, but still he can be seen as he rises about one hour before the Sun.

VENUS.

During the latter portion of the month Venus may be seen in the west, just after sunset, setting, on the 10th, at 6.16 even.; 20th, 6.40 even., and 30th at 7.4 even.

MARS.

The flattened appearance, or rather gibbous phase of Mars will be more noticeable this month than again this year. He arrives at eastern quadrature April 1st, and the Moon passes 3° south of him on the 26th. Mars never has the horned or crescent phase, but appears slightly gibbous at quadrature. He passes the meridian on the 10th at 7.2 even.; 20th, 6.39 even., and 30th at 6.18 even. As Mars is two months in passing over one sign he will not be far from the place given last month,

JUPITER.

As it takes Jupiter an entire year to move over one sign, or 30°, his position, with respect to the stars, changes very slightly from month to month. He sets as follows: 10th, 11.5 even.; 20th, 10.37 even., and 30th, 10.7 even. He passes 1° south of the crescent Moon on the 23d.

FAVORABLE TIMES FOR OBSERVING THE PHENOMENA OF JUPITER'S SATELLITES.

(For an inverting telescope at 8h. 42m. even., New York City Time.)

On the 2d all will be upon the east, I., II., and III. close together, and IV. very distant. Again, upon the 16th none will be visible upon the west, and only II. and IV. upon the east, the others being in the planet's shadow or in eclipse. And again, on the 31st, all will be upon the east, only II., III., and IV. being visible, the last being very close to the planet. I. is in transit, which began at 8.19 P.M. On the 9th and 26th IV. may be seen at greatest distance west, and on the 1st and 18th greatest distance east. On the 7th, 8th, and 28th all will be upon the west side. On the 27th, at the above time I., II., and IV. may be seen at very nearly their true relative distances from the planet, and were III. as far again to the west it would be in the proper place.

The following are the visible eclipses of Jupiter's satellites which occur this month:

	D.	*H.*	*M.*			
I.—	2	6	36	even.	Reappearance,	E.
I.—	9	8	32	"	"	
II.—	12	6	53	"	"	
III.—	16	8	34	"	Disappearance,	E.
III.—	16	10	17	"	Reappearance,	E.
I.—	16	10	27	"	"	
II.—	19	9	30	"	"	
I.—	25	6	52	"	"	

SATURN.

The position of Saturn is better than last month, being lower; and we always feel repaid for looking at him. He sets as follows: 10th, 10.0 even.; 20th, 9.25 even.; 30th, 8.46 even. The Moon passes 4° north of him on the 22d.

ALGOL.

Algol may be seen at minimum brilliancy as follows:

February	15,	11.37 even.
"	18,	8.26 "
March	5,	4.30 morn.
"	8,	1.19 "
"	10,	10.8 even.
"	13,	6.57 "
"	28,	3.1 morn.
"	30,	11.50 even.

APPEARANCE OF THE HEAVENS AT 9 P.M. MARCH 20, 1882.

Looking southward very nearly all of the brightest stars are west of the Meridian. The Pleiades and Hyades in Taurus are near the western horizon; Gemini is above them, and Cancer is on the Meridian. As there are 12 signs in the Zodiac and 12 months in a year it is plain that the signs of the Zodiac must be 30° farther west than last month at the same hour. West of the Meridian, Leo, the Sickle, and Regulus are the first in the Zodiac; above them is Leo Minor, marked by one or two large thick clusters. Still east of Leo is Virgo and Spica, and above her is Berenice's Hair on a line and midway between the Sickle and Arcturus.

Looking northward, The Dipper is to the right of the upper Meridian; the Little Dipper (in Ursa Minor) to the right of Polaris; the principal stars of Draco below Polaris, and Cassipea's Chair at the left and a little below the Pole Star.

THE MOON, VII. 3D OR S. E. QUADRANT.

The region about the southern pole seems to possess several objects which bear marks of great age and hard usage. Just below Clavius is what appears to be the "ruins of a vast complex ring." The interior is depressed some 14,000 feet. Look for it just after First Quarter. It is number 195 on the map, and is called Maginus. At 200 begins a series of lunar circles extending northward and called the Great Crater Range. The Range consists of five walled plains of vast extent, and in some instances crater within crater, and the walls surmounted by lofty peaks. They seem to resemble to some extent existing features in the Andes and other ranges. The first one, 200, has lofty peaks on its rampart. The next one, 201, seems to be connected with both the one above and below, and has a high peak on the west side. The one below, 202, is 7,500 feet deep, and below this and just to the right lies one 32 miles across and with walls which rise in places 9,800 feet above the central cavity. Just east of this is the "Straight Wall." This curious formation has, we believe, been mistaken either purposely or otherwise for a work of art, and it is well calculated to deceive in that respect, for it is exceedingly regular, of uniform height, sloping gradually to the "ditch" at the base of the east side. Its height is about 1,000 feet, and it terminates at one end in a crater and at the other in a branching mountain. Best seen one or two days after First Quarter, or shortly after Third Quarter. The central member of the Lunar Circles, 204, is 65 miles across, and on its west side has a peak 13,600 feet high. Just below and a trifle to the right is 205, the most interesting of the series. It is over two miles in depth, and in consequence of this great depth its lowest recesses are almost always in darkness, being only free from shadow for five days in a lunation. It is a fine sight to see the Sun rise upon

the top of the peak, making a golden island in a sea of darkness. This central peak is 7,000 feet high. The next one northward is 207, 83 miles in diameter, with a central peak 4,000 feet high; and the last, 208, just south of the Moon's centre, is the largest of the chain, having a diameter of 115 miles. The interior plateau has a roughened surface, and at sunrise (Lunar) the surface appears like a vast lake roughened with waves, but these "waves" are about 100 feet high! Portions of its ramparts are 12,800 feet high, and some authorities claim there are 46 interior craters.

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS, MARCH 21, 1882.

	H.	M.	
Alpha Andromeda (Alpheratz) sets	7	56	even
Omicron Ceti (Mira) variable "	8	4	"
Beta Persei (Algol) variable "	0	15	morn
Eta Tauri (Alcyone or Light of Pleiades) sets	11	11	even
Alpha Tauri (Aldebaran) sets	11	29	"
Alpha Aurigae (Capella) in merid.	5	11	"
Beta Orionis (Rigel) " "	5	12	"
Alpha Orionis (Betelguese) " "	5	52	"
Alpha Canis Majoris (Sirius or Dog Star) in merid.	6	43	"
Alpha Canis Minoris (Procyon) in meridian	7	36	"
Alpha Leonis (Regulus) in merid.	10	4	"
Alpha Virginis (Spica) rises	7	58	"
Alpha Bootis (Arcturus) "	7	1	"
Alpha Scorpionis (Antares) rises	0	8	morn
Alpha Lyrae (Vega) "	9	41	even
Alpha Aquillae (Altair) "	1	21	morn
Alpha Cygni (Deneb) "	10	44	even
Alpha Pisces Australis (Formalhaut) invisible.			

Penn Yan, N. Y.

Correspondence.

Starch as a Wood-Filler.

Ed. Young Scientist—In the December number of the YOUNG SCIENTIST corn starch is recommended as a filler for porous hard woods. In polishing black walnut and other dark woods I have used corn starch, and I have colored it with different materials; but I have always found that it became grey after a time and destroyed the beauty of the wood. What has been the experience of other readers of the YOUNG SCIENTIST?

A great many trials lead me to believe that any light, porous, and unalterable powder is good for this purpose. I have used fine chalk, ground up with coloring matter to suit, but the best that I have found is the powder used for making dynamite and soluble glass. I believe it is called *diatom earth.* It is of various colors, from almost pure white to dirty brown, and of course may be tinted to any shade we want it. It is unalterable, fills the pores well, sets quickly, and receives the final polish splendidly.

V. ARNISH.

An Addition to the "Blue Process."

Ed. Young Scientist—I have just read the article on "Blue Process of Copying Drawings" in the January number of YOUNG SCIENTIST, and think I can make a valuable addition, at least it has proved to be so to me, both in saving time and doing better work. In place of tracing cloth or tracing paper, I use ordinary paper of a quality hardly as good as that on which the YOUNG SCIENTIST is printed. Make a pen-and-ink drawing, allow it to dry, and then thoroughly saturate it with ordinary (so-called) olive oil (but which is really pea-nut oil); it dries quickly, and leaves the paper very clear.

A. W. BAILY.

Atlantic City, N. J., Jan. 12, 1882.

How to Soften Dry Bird Skins.

As usual with all processes in taxidermy, there are various ways in which a dried bird skin may be relaxed and made ready to mount, but I will describe the one I consider the simplest, easiest, and most effective.

1. *For Small Birds.*—Open the skin and remove the filling from the body, neck, and head. Tear some old cotton cloth into strips from an inch to two inches in width, wet them thoroughly in warm water, and wrap them round the leg and foot until it is covered with several thicknesses of the wet cloth, quite to the ends of the toes. Lift up the wing and put two or three thicknesses of wet cloth round the joint, and also between the wing and the body. Put some wet cotton or small rags inside the skin, wrap the whole skin completely in several thicknesses of cloth and lay it aside. If the bird is not larger than a robin, the skin will be soft enough to mount in about twelve to fourteen hours.

2. *For Large Birds.*—Under this heading it is necessary to place nearly all birds above the size of the robin, for the reason that the legs, being large and thick in comparison with the skin of the body, require extra treatment. The legs of some birds require several days' soaking, and were the skin of the body relaxed for the same length of time it would macerate and the feathers fall off. The legs of large birds must therefore be started first in the relaxing process.

Take, for example, the skin of a pheasant: cover the nails and beak with wax, if the skin

is an old one, or else they will flake off; wrap the feet and legs with wet cloths as described above, and let the skin lie without other wrapping for one day. At the end of this time the joints can be bent somewhat, and they should be manipulated until they bend easily. When they will do this, put wet cloths round the joints of the wings—in the body, neck, and head, and wrap the whole skin in a wet cloth. At the end of the second day the entire skin will be soft. The next step is to scrape all the hard parts of the skin and manipulate it until it is as soft as when fresh.

This process applies, with slight modifications, to all large bird skins, but, of course, the larger the bird, the longer it will take to relax. Sometimes the wings require soaking half as long as the legs in very large birds but care must be taken not to soak any feathered parts too long or the feathers are liable to drop out and cause serious trouble.

By the above process, skins may be softened and made ready to mount according to their size, about as follows: Wren to robin, in twelve to fourteen hours; ruffed grouse, two days; great blue heron, three days; bald eagle, four days; condor, five days; ostrich, six to eight days. Skins which are but a few months old will soften in about half the time they would require were they five years old, and if properly made in the first place will make as handsome mounted specimens as fresh skins.—*W. T. H., in Ward's Natural Science Bulletin.*

Cleaning and "Dipping" Brass.

The following process is said to be in use in the government arsenals: Make a mixture of one part common nitric acid and one-half part sulphuric acid in a stone jar; then place ready a pail of fresh water and a box of saw-dust. Dip the articles to be cleaned in the acid, then remove them into the water, after which rub them with saw-dust. This immediately changes them to a brilliant color. If the brass is greasy it must be first dipped in a strong solution of potash and soda in warm water. This dissolves and removes the grease so that the acid has the power to act.

Dyeing Ivory.

Almost all articles made of ivory look best when this material is left of its natural color—pure white. For some purposes, however, a contrast of color is desirable, and in such cases recourse must be had to dyeing. The following formula have been found to give good results. It is well to note that unpolished ivory takes color better than polished. Ivory must not be boiled long in liquids, and, according to Karmarsch, when taken out of hot liquid should be rapidly cooled by laying in cold water. Ivory is very sensitive to change of temperature, and while it will stand the treatment just mentioned, will not stand forcible blows when cold

1. *Black.* Boil for a short time in a strained solution of logwood, afterwards immerse in a solution of green sulphate of iron.

2. *Blue.* Immerse for a short time in a dilute solution of indigo-carmine.

3. *Yellow, a.* Immerse for a few minutes in water containing a little stannous chloride (protochloride of tin); afterwards in a hot, strained decoction of fustic.

b. Immerse for about fifteen minutes in a solution of chromate of potassium.

4. *Orange.* Treat as in the first process for yellow, but add to the fustic some shavings of Brazil-wood (Pernambuco-wood).

5. *Red, a.* Macerate cochineal in vinegar, and boil the ivory in the liquid for a few minutes.

b. Carmine dissolved in ammonia may be used. The tint is more purple-red.

c. Immerse in a very dilute solution of stannous chloride, and afterwards in a boiling solution of Brazil-wood. A little fustic turns the color to scarlet.

d. Ivory dyed as last directed is rendered cherry-red by immersion in a very dilute solution of potash.

e. Immerse in an alcoholic solution of alizarin-paste.

6. *Violet, a.* Dye red first; then immerse for an instant in solution of indigo-carmine.

b. Macerate in dilute solution of stannous chloride; then dip into a hot decoction of logwood. If the article be afterwards laid in water acidulated with a few drops of nitric acid, the color turns purple-red.

7. *Green, a.* Dye first yellow, and afterwards dip into solution of indigo-carmine.

b. Place for several hours in concentrated solution of chromate of potassium; afterwards expose to sunlight; this produces a dark, bluish-green tint.

Practical Hints.

Blue Prints.—An improved method of making cyanotypes, which gives a blue picture with a pure white ground, is described by Eder.

Well-sized paper is painted over with a brush with the following solution, freshly prepared; 30 volumes of gum Arabic solution (1 to 5), 8 volumes solution of citrate of iron and ammonia (1 to 2), 5 volumes solution of perchloride of iron (1 to 2). The mixture appears limpid at first, but soon grows thicker.

The paper is dried in the dark, then exposed

for a few minutes under a negative or drawing, and developed with a solution of one part ferrocyanide of potassium in 5 parts of water applied with a brush. It is fixed with dilute hydrochloric acid, 1 to 10, washed thoroughly and dried.—*Boston Journal of Chemistry.*

Sulphur as a Lubricator.—This substance has been long known as a most excellent anti-friction agent, and it has of late been very successfully used by the steamers of the North German Lloyds. The sulphur is mixed with oil or grease and applied like any ordinary lubricator. It combines with the fine metal dust worn off by friction and entirely prevents heating.

Liquid Glue.—The *Muster Zeitung* recommends, in preference to the treatment of glue with nitric acid, the following: So-called gelatine is dissolved in the water-bath in its own weight of strong vinegar, a quarter part of alcohol, and a very little alum. This glue remains liquid when cold, and is much used for cementing mother of pearl, horn, etc., upon wood or metal.

Treatment of New Files.—A new file should be used with a light pressure until the very thin sharp edges are worn off, after which a heavier pressure may be used with much less danger of the teeth crumbling at the top or breaking off at the base. Every filer should keep a partially worn file to use first on chilled surfaces or gritty skin of castings, or on a weld where borax or simiiar fluxes have been employed, or on the glazed surface of saws after gumming.

Stove Polish.—The fine polish given stoves by those skilled in the art, is produced as follows; Have a thin mixture of black varnish and turpentine; apply this with a paint or varnish brush to a portion of the stove; then with a cloth dust this over with pulverized British lustre or stove polish: then rub with a dry brush. The stove must be perfectly cold. The stove dealers buy the pulverized stove polish, which is carburet of iron, in 25-lb. packages. The process conducted in this manner is quite brief, but gives beautiful results.

Plate Polishing Paste.—The *English Mechanic* states that an excellent preparation for polishing plate may be made in the following manner: Mix together 4 ounces spirits of turpentine, 2 ounces spirits of wine, 1 ounce spirits of camphor, and ½ ounce spirits of ammonia. To this add one pound of whiting, finely powdered, and stir till the whole is of the consistency of thick cream. To use this preparation, with a clean sponge cover the silver with it, so as to give it a coat like whitewash. Set the silver aside till the paste has dried into a powder; then brush it off, and polish with a chamois leather. A cheaper kind may be made by merely mixing spirits of wine and whiting together.

To Bleach Straw.—Dissolve 108 grains (about 4 ounces) permanganate of potash (crystals) in 5 liters (or quarts) of hot water. Mix this solution in a tub of water until the water is a deep red. Enter straw which has previously been softened for several hours in a tepid bath of soda and well rinsed. Agitate the straw frequently. It will turn deep brown; if not, add some permanganate solution; leave it in till discoloration of the bath. When the straw is of a drab shade, rinse in cold water and enter in a bath of sulphurous acid. Make it of a sufficient degree to give forth odor. The discoloration of the straw takes place within 30 minutes, and generally turns a good white.

Science Gossip.

Ocean Wave Power.—The Swales Ocean Wave Power Company has incorporated, to furnish power by means of the action of ocean waves and tides with which to supply salt water for watering streets, flushing sewers, supplying public and private baths, extinguishing fires, and other public and private purposes; for driving machinery, compressing air, generating electricity, and for all manufacturing and commercial purposes.

A Great Telescope.—The observatory in the neighborhood of Nice, which is being erected at the expense of M. Bischoffsheim, is rapidly approaching completion. The great equatorial telescope is to be one of the largest in the world—perhaps the largest—as it will have an object glass three feet in diameter and a focal length of upwards of fifty feet. The construction of this monster telescope has been intrusted to MM. Paul and Prosper Henry, of Paris, and the total cost of the observatory will be more than $400,000 in American money.

Spiders Obstructing the Telegraph.—One of the chief hindrances to telegraphing in Japan is the grounding of the current by spider lines. The trees bordering the highways swarm with spiders, which spin their webs everywhere between the earth, wires, posts, insulators, and trees. When the spider webs are covered with heavy dews they become good conductors and run the messages to earth. The only way to remove the difficulty is by employing men to sweep the wires with brushes of bamboo, but as the spiders are more numerous and persistent than the brush users, the difficulty remains always a a serious one.

The Light of the Stars.—For a number of years the special work carried on at the Harvard observatory, under the direction of Prof. Pickering, has been the measurement of the intensity of the light of the heavenly bodies. Some of the results presented at a recent meeting of the Society of Arts, at the Institute of Technology, Boston, indicate measurements almost incredibly fine. The light which falls upon the earth from the satellites of Mars, for example, is about equivalent to what a man's hand on which the

sun shone at Washington would reflect to Boston. The labor of measuring the brightness of all the visible stars was begun two years ago. It has since gone on at the rate of about 40,000 a year, and will be completed next fall.

QUESTIONS AND ANSWERS.

Burning Iron Wire with a Battery.—Can anyone tell me how to heat or burn iron wire, and other experiments with the tin can battery described in vol. 1. H. A. K.

Ans.—In making this experiment three points require care: 1. See that the battery is in vigorous action. 2. When only one cell is used, see that the wires attached to the poles are short and stout, and well soldered to the copper and zinc. 3. See that the iron wire is short and very fine. The conductors or wires should not be more than twelve inches long, the solutions must be strong and warm. The finest iron wire—not thicker than a human hair—must be used. Such wire may be procured from most dealers in wire, or any watch maker can give you a bit of the balance-spring of a watch (not the main-spring). You should have no difficulty in burning a bit of fine wire with a single quart cell. Wollaston used to astonish his friends by igniting a piece of fine platinum wire by means of a battery made out of a lady's silver thimble.

How can brass drawing instruments be made so they will not tarnish and have that bad smell? An answer to the above will oblige a

Brass Monkey.

Ans.—We find that a correspondent of *Carpentry and Building* asks a similar question in regard to bird cages, and is answered as follows: "After thoroughly cleaning and removing the last traces of grease by the use of potash and water, the cage or other brasswork must be carefully rinsed with water and dried, but in doing it care must be taken not to handle any portion with the bare hand, nor anything else that is greasy. The preservative varnish may be shellac much diluted with alcohol, or it may be hard oil finish. We have tried the latter and found it to work very well. In either case the brass should be made pretty warm, and the varnish or shellac put on with a brush in as thin a coat as possible. In some places the stores sell the shellac varnish under the name of 'lacquer.' It is considerably thinner than the ordinary bronze shellac, and rather a nicer article. The proportion of shellac to alcohol is about two ounces of shellac to nine ounces of alcohol. Sometimes gamboge is used for a coloring matter to make the varnish more yellow, and sometimes dragon's blood." We fear, however, that any lacquer or varnish would soon disappear from articles which are handled as much as mathematical instruments. The best method is to have them nickel-plated, or if you are about to purchase a set, get them of German silver.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business matter in letters or cards they are filed away and never reach the printer.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

Model card press, chase 3¼ x 5¼, with 4 fonts type, cases, etc., for good foot lathe. Mills Day, 2 Farmington Av., Hartford, Ct.

French microscope, inclines to any angle, delicate fine motion, neat upright case, cost $17.50, for scientific books; send list to W. Fitz, P.O. Box 2852, New York.

Wanted, Quinby's New Bee Keeping, for Our Own Birds of the United States, by W. S. Baily; new. Joseph Anthony, Jr., Coleta, Whiteside Co., Illinois.

Printing type, small pica; large and small capitals, and small letters; 60 to 65 lbs., including two large cases; also gothic nonpariel, for trade. J. Siler, 1242 Broadway, St. Louis, Mo.

One years' copy of Aldine, cost $5.50, and German accordion, with instructions how to use it, cost $5.00, for offers. Chas. Dempwolf, 86 Benson St., Paterson, N. J.

A Novelty printing press, with type, prints a form 5 x 7 inches, cost $40.00, for a microscope, photographic apparatus, or offers. T. W. Patterson, Warsaw, N. Y.

$80 worth of (nearly new) printing material, minerals, fossils, Aboriginal relics, etc., for scientific books, good American watch, and offers. F. M. Farrell, Cobden, Union Co., Ills.

Rocks, minerals, fossils and fresh water shells for microscope stand, $20 to $75, also for objectives, turning lathe, type, and tools. D. D. Babcock, South Dansville, N. Y.

Mechanical Electricity, Medical Chemistry, by Robert Hare; Fruits and Farinacea, by Trall; Complete Herbalist, by O. P. Brown; for mounted objects for the microscope or offers. J. B. Playter, Bristow, Butler Co., Iowa.

Violin (cost $10) and 5-shot 32-cal. revolver (cost $4), for photo-camera lens and tube, watch, parlor rifle, extra well-bred canary birds, or offers. C. Maides, St. Louis, Mo.

To exchange for a wood-turning lathe or offers, a Young America Self-inking Printing Press, with type and outfit complete; chase 3 x 5 inches. Embury McLean, 318 Bloomfield St., Hoboken, N. J.

What offers for "Our First Century," cost $7.00, bound in sheep, over 400 illustrations, 1,000 pages; also small Ruby Magic Lantern, cost $1.50. Box 217, So. Manchester, Conn.

Magic lantern, in good order, condensing lens, 2½ in. diameter, 8 slides. For small photographic camera or offers. H. A. Giddings, 4 Union Place, Classon Ave., Brooklyn.

Printing press, type, etc., worth $13, for offers. E. G. Vogeley, 1010 Bradford St., Pittsburgh, Pa.

Fifty canary birds, with and without crests; fancy poultry, conch shells, strombus alatus. For small printing press, books on natural history, or offers. Frank Lattin, Gaines, N. Y.

A good plain 7 shot revolver, 22 calibre, for a Students' inch or half-inch objective. Frank F. Colwell, Urbana, Ohio.

Wanted, Printing press and type, in good order, chase 6 x 10, or larger; will give hardware, tools, scroll saw, or designs. Chas. E. Little, 59 Fulton St., New York.

Photo outfit, tools, chemicals and apparatus, etc., etc.; wanted scientific books, apparatus, etc.; send lists. A. B. Campbell, Box 59, South Dayton, Catt. Co., N. Y.

Stuffed birds, insects or job printing (cards, labels, etc.) for mounted objects for the microscope. James P. Melzer, Milford, N. H.

A ring stand, filtering stand, calcium light jet and a gas holder, holding one cubic foot, for a phonograph. D. P. Smith, 59 Park Place, New York.

THE Young Scientist

SCIENCE IS KNOWLEDGE. KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

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The Lucifer Match.

COMMON and apparently simple as is the lucifer match, it is not half a century since it was invented, and strange to say the originator is entirely unknown, although he has probably done as much to add to the happiness of the human race as any other inventor. Matches have been in use for hundreds of years, but it was only about the year 1835 that a really serviceable match—one that could displace the old flint and steel—was brought forward. Two years before that, Faraday, the greatest chemist of his age, published a new edition of his book on Chemical Manipulation, and in that he advises the use of flint and steel, or the old "dipping match" as the best means of getting a light. We may, therefore, safely conclude that a really good match was not known at that time. The following story about the origin of the match is now going the rounds of the press, but is evidently a mere story:

"A famous chemist, Mr. Isaac Holden, on rising early one morning to pursue his studies in science, was exceedingly incommoded by the difficult method of striking a light from flint and steel, and the idea occurred to him to use some explosive firework. When delivering a lecture shortly afterwards, he said that of course he knew, as other chemists did, the explosive material that was necessary in order to procure instantaneous fire; but it was very difficult to obtain a light on wood by that explosive, and the idea occurred to him to put sulphur upon the explosive mixture, which he demonstrated. A person in the lecture room who knew a chemist in London wrote to him about it, and in a few days lucifer matches were issued."

"Explosive fireworks" had been used for this purpose for a long time before the modern match was invented. The old "dipping" matches consisted of a wooden splint, the end being coated with sulphur and tipped with a mixture of chlorate of

potassa, sugar, and sulphide of antimony. These matches, when dipped into sulphuric acid, took fire and gave a light. The acid was kept in a bottle filled with asbestos, which served the purpose of a sponge, and such bottles with one hundred matches were sold for seven shillings and sixpence, or nearly $2.00!! Just think of paying two dollars for a box of matches!

The modern match was invented when somebody made an emulsion of phosphorus in glue, adding nitre, red lead, antimony, etc., to color and improve it. Sulphur had been used long before, both on plain matches, used for getting a light from flint, steel and tinder, and on the old chlorate matches, but this did not make them a really serviceable article. The use of phosphorus in the way we have described at once gave us a useful match, easily ignited by gentle friction on any rough surface. The old flint and steel was by no means a bad implement for getting a light. In skilful hands it is certain, simple, and always obtainable. It would be far better than the matches described by Holden. They required great effort to ignite them, and very frequently failed. We have seen boxes of these old matches, and only about one-third of them would ignite by the most careful handling. And we have made them after the best prescriptions of Accum and others with like results. The modern lucifer match can be used by a child, and it is a great pity that the name of the inventor is unknown.

Glass Working.

THE young experimenter will find frequent difficulties and meet with many accidents in working glass, owing to the fact that when this substance is not properly "annealed" it is very brittle—the slightest scratch causing it to fall to pieces. Two hollow balls of glass (like those used for shooting),* if made of good material and well annealed, may be suspended by strings like two pendulums, as shown in Figure 1, and then if one be drawn aside into the position shown in the dotted lines, and allowed to fall, the other will rebound as if made of india rubber! We have been surprised ourselves, and have surprised many an audience by the force with which the two balls may be allowed to strike together without breaking. But if the balls be unannealed, they will not stand this rough usage. Glass is annealed by heating it

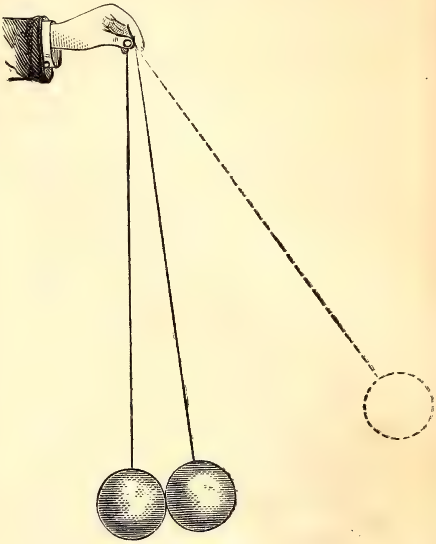


Fig. 1.

very hot—almost to the point of softening—and then allowing it to cool slowly for several days. To make the cooling very gradual, a special oven called a "leer" is provided, and all good glass ware must be passed through the leer in order to make it stand. When the glass makers are hurried, they sometimes do not give sufficient length of time to the process, and the consequence is that the glass soon breaks in pieces. Indeed, so easily broken are articles in this condition that we have frequently had jars and other vessels fall to pieces of themselves. But even when not so bad as this it will often happen that if the article is a tumbler or dish, it breaks when hot water is poured into it, and if it is a lamp chimney, it cracks on the slightest provocation. A

*The balls used for shooting are made expressly *to be broken*. Therefore no care is taken to anneal them, and they will not answer for this experiment. Balls, specially annealed for the purpose, are sold by dealers in philosophical apparatus.

common recipe for annealing lamp chimneys is to boil them in water, and allow them to cool gradually. This does not heat them enough, however. If salt were dissolved in the water it would be still better, and if the chimney were placed in an oven which was allowed to cool very gradually, it would be better still. It is the *gradual cooling* from a high temperature that does the work, as the particles of glass then have time to arrange themselves properly.

An example of glass in a condition the very opposite of the balls just described, may be seen in the Rupert Drops, shown in Fig. 2. These are drops or tears of

Fig. 2.

glass which have been allowed to fall into water so as to cool them suddenly. The outer portion of the glass then contracts before the inner portion has time to cool, and the consequence is that the surface is in a state of high tension. If we take one of these drops, and break off the slender tail, the shock of the fracture will be communicated to every part of the drop, and it will fall to pieces, as shown in Fig. 3. Sometimes the glass arranges itself in centres of compression, as shown in Figures 4 and 5.

When the glass is broken in this way, its volume suddenly enlarges and the pieces fly from each other with considerable force. It is best, therefore, to wrap the drop in paper before breaking off the end. That which a moment before was a solid, clear piece of glass will now be found to be a fine powder.

The effect of the expansion, etc., may be curiously shown by breaking the drop in a thin glass bottle filled with water. The force of the blow will be transmitted

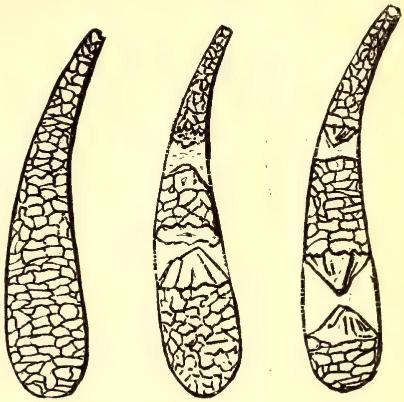


Fig. 3. Fig. 4. Fig. 5.

through the comparatively incompressible water, and the glass vessel will be broken. This is a very curious and startling experiment.

Another form of annealed glass is seen in the so-called Bologna phial, of which we shall give a description in our next article. It forms a most curious and useful study, teaching us a great deal that is very important and useful about the care and management of glass vessels.

Unconscious Effort.

DAILY instances of unconscious effort present themselves to us, and would be noted and understood if we only knew how to detect them. Amongst those who have had no training in the more delicate manipulations of science and of refined life, we constantly see the unconscious exercise of great and unnecessary force. Such persons, if asked to wipe a delicate glass vessel, will twist it in two and wonder why it breaks! They have probably applied a force of several pounds where as many ounces would suffice, and a fracture is the result. The table tipper and spiritualist take advantage of this and get them to place their hands on a

table, and lo, the table tips or moves off, and they declare that they are exerting no force! Faraday early detected this curious psychological peculiarity, and met it by the simple but very scientific process of indicating and measuring the force applied. In every case in which motion was produced, it was found that the exact amount of force required to produce this motion was applied, but, strange to say, when the indicator was exposed to the view of the operator or "medium," so that he or she was fully aware of the power they exerted, no force was applied and no motion resulted. Strange to say, women seem to be more liable to the exertion of this unconscious effort than men, and this both in the case of "mediums" and in ordinary life. In our experience we have found that girls are far more apt than boys to put forth a superabundance of strength and "break things." And yet they will tell you that they did not use much force, and no doubt believe it.

One of the most singular instances of unconscious effort is that long ago described by Sir David Brewster. Writing to Sir Walter Scott, he says:

"One of the most remarkable and inexplicable experiments relative to the strength of the human frame is that in which a heavy man is raised with the greatest facility, when he is lifted up the instant that his own lungs and those of the persons who raise him are inflated with air. This experiment was, I believe, first shown in England a few years ago by Major H., who saw it performed in a large party at Venice under the direction of an officer of the American navy. As Major H. performed it more than once in my presence, I shall describe as nearly as possible the method which he prescribed. The heaviest person in the party lies down upon two chairs, his legs being supported by the one and his back by the other. Four persons, one at each leg, and one at each shoulder, then try to raise him, and they find his dead weight to be very great, from the difficulty they experience in supporting him. When he is replaced in the chair, each of the four persons takes hold of the body as before, and the person to be lifted gives two signals by clapping his hands. At the first signal he himself and the four lifters begin to draw a long and full breath, and when the inhalation is completed, or the lungs filled, the second signal is given, for raising the person from the chair. To his own surprise and that of his bearers, he rises with the greatest facility, as if he were no heavier than a feather. On several occasions I have observed that when one of the bearers performs his part ill, by making the inhalation out of time, the part of the body which he tries to raise is left, as it were, behind. As you have repeatedly seen this experiment, and have performed the part both of the load and of the bearer, you can testify how remarkable the effects appear to all parties, and how complete is the conviction, either that the load has been lightened, or the bearer strengthened by the prescribed process.

At Venice the experiment was performed in a much more imposing manner. The heaviest man in the party was raised and sustained upon the points of the forefingers of six persons. Major H. declared that the experiment would not succeed if the person lifted were placed upon a board, and the strength of the individuals applied to the board. He conceived it necessary that the bearers should communicate directly with the body to be raised. I have not had an opportunity of making any experiments relative to these curious facts; but whether the general effect is an illusion, or the result of known or of new principles, the subject merits a careful investigation."

In an illustration we give another method of performing this experiment. This method has been recently revived in France, and is as follows: Two individuals place the forefingers of their right and left hands under the feet of the person to be lifted; two other persons place the forefingers of their hands under his elbows, and another places the same finger under his chin. At the command *one, two, three!* each person makes a vigorous effort upward, and the individual under experiment is lifted up with surprising ease. Although the experiment never fails to astonish those who behold

it, there is really nothing wonderful about it when we reflect upon it. It is a simple example of equal distribution of weight. A man weighs on an average about 150 pounds, and each finger, therefore, lifts about 21½ pounds. And as the total effect is so surprising, the individual performers are unable to estimate the amount of force used, and consequently exert much of it unconsciously. Each one thinks that he applies only two or three pounds.

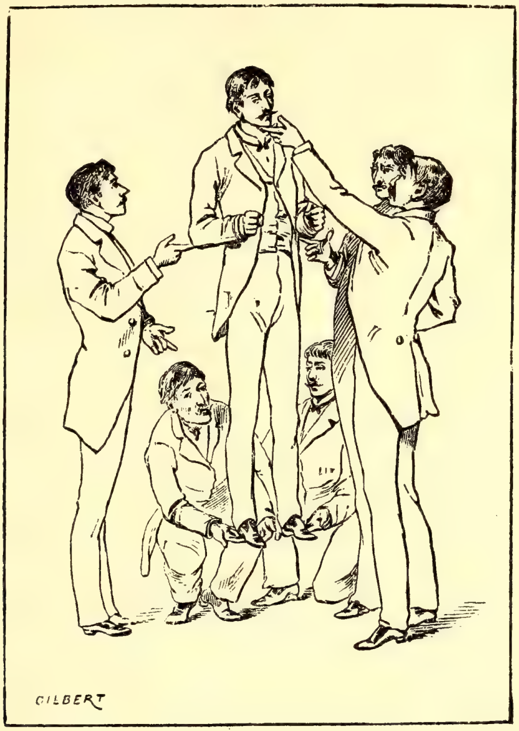


ILLUSTRATION OF UNCONSCIOUS EFFORT.

To Design a Monogram.

SCARCELY anything seems so easy as to design a monogram, yet we see very few successful ones, the most of them being a mass of mixed-up letters and ornament, of which we can find neither the beginning nor the end. There is a law regulating the designing of everything, and it is this law which the true designer keeps in mind and applies to his work; the effects of obedience to this law and its violation are seen as clearly in the design for a monogram as in the design for a cathedral.

First, there should be harmony of composition—that is, the letters should so emphasize, subdue, or control each other that the composition should impress us as compact, appropriate, and, being so, beautiful.

Second, there should be no unnecessary ornamentation; there should be a quiet and peace about the design which will always please the truly artistic. Looking at some designs, we get the impression that ornament was so plentiful that the designer saw no other means of consumption than that of burying his designs in it, for we see that there is a mass of curves, angles, shades and leaves, but nothing else.

Third, simplicity of lettering is an important requisite, as there should be no possibility of mistaking an E for a G or C, and the boundaries or outlines of the letters should be well defined.

Fourth, the order of sequence of the letters should be carefully attended to.

The common idea is, that a certain number of letters are given with which to make a pleasing design, and so far, that impression is right; but there is something beyond this. There is the art of so

placing the letters that one can distinguish at a glance the first, the central, and the last letter. Now the rule to be observed to secure this result is as follows: The *last* letter of the monogram must be the principal feature, and must be the largest, the boldest, and the heaviest letter; then the *first* letter must be the next in size, but the lightest in outline and color; then the *central* letter must be the smallest and of an intermediate tint. If the monogram is of four letters, the two intermediate must be the same size and the second letter lighter in outline and color than the third.—*Art Amateur.*

The French Diapason.

THE Italian Theatre, in Drury Lane, London, has adopted our normal diapason. This is a very small victory for France, and one which should be followed by others more desirable. It is, however, a *victory*, and we find pleasure in recording it for want of a better one. We will recall to those who may have forgotten it, what the normal diapason is. It is the agreement in virtue of which the note obtained by a sonorous body which makes 870 vibrations in a second at the temperature of 15 degrees centigrade, is called *La*. This *La* is the note which is situated a little above the first half of the key-board of a piano; it is the one which is the medium of female voices; and also the one which is given by the next string to the treble string upon a violin. It is easily seen that *one* of the notes of the gamut having been settled, the positions of all the other notes will be established, since they have regular intervals between them. It would be the same with a mason's ladder hung up on a wall; if you should take one of its rounds and elevate or lower it a certain distance, all the other rounds would be either elevated or lowered in the same proportion. Since the 1st July, 1859, the diapason at 870 vibrations has been obligatory by ministerial decree. It was quite time, however, to stop its ascensional progress. From the last of the Seventeenth century the diapason without official restraint went up, up, up! We can judge of this from the following table:

In 1699,	*La* =	808	vibrations.
1713	"	812	"
1780	"	818	"
1810	"	846	"
1823	"	862	"
1830	"	871	"
1836	"	882	"
1868	"	891	"

Why did they select *La* as the standard note before regulating the degree of acuteness of all the others? Thereupon hangs a legend which I must relate to you. In the last years of the Seventeenth century the society of the "Vingt-Quatre violins de la chambre du Roy" began to feel the urgent need of having a fixed diapason. But where find that point which should be an unchangeable standard for reference at all times? Chance furnished it. In fact it was found only when the open *La* of the fiddlers corresponded in a small measure with the note given by the great clock (*bourdon*) of Notre Dame (taking into consideration, of course, an interval of several octaves). It was a happy coincidence, and they profited by it.

If eventually the *La* had not ceased ascending, to the great detriment of singers voices, the blame should not have rested upon any but the instrumentalists, who, in their desire to shine, elevated more and more the diapason of their instruments. In 1859, that is to say, in the epoch of the ministerial decree, which took the position of police of the gamut, the diapason of Paris was 896 vibrations; that of Lille 904; that of Milan 900; that of St. Petersburg 903; that of Berlin 903. Sooner or later it will be seen that all musical Europe will sustain the rule of our diapason, and stand in unison with us, which will constitute a sort of European equilibrium.—*Courrier des Etats-Unis.*

Girls as Housekeepers.

BEGIN with your own things and your own place. That is what your mother will tell you if your rush to her, enthusiastic with great intentions, and offer to relieve her of half her housekeeping. Reform your bureau drawer, relieve your closet pegs of their accumulation of garments out of use a month or two ago. Institute a clear and cheerful order, in the midst of which you can daily move; and learn to keep it. Have your little wash cloths and your sponges for bits of cleaning; your furniture brush and your feather duster and your light little broom and your whisk and pan; your bottle of sweet oil and spirits of turpentine, and piece of flannel to preserve the polish or restore the gloss where dark wood grows dim or gets spotted. Find out, by following your surely growing sense of thoroughness and niceness the best and readiest way of keeping all fresh about you. Invent your own processes; they will come to you. When you have made yourself wholly mistress of what you can learn and do in your own apartment, so that it is easier and more natural for you to do it than to let it alone—so that you don't count the time it takes any more than that which you have to give to your own bathing or hair dressing—then you have learned enough to keep a whole house, so far as its cleanly order is concerned.—*Ex.*

SONGS OF THE SCIENCES.

Oh! merry is the Madrepore that sits beside the sea,
The cheery little Coralline hath many charms for me;
I love the fine Echinoderms of azure, green and gray,
That handled roughly, fling their arms impulsively away;
Then bring me here the microscope and let me see the cells,
Wherein the little Zoophyte like garden floweret dwells.

We'll take the fair Anemone from off its rocky seat,
Since Rondelitius has said when fried 'tis good to eat;
Dyspeptics from Sea Cucumbers a lesson well may win,
They blithely take their organs out and then put fresh ones in.
The Rotifer in whirling round may surely bear the bell,
With Oceanic Hydrozoids that Huxley knows so well.

You've heard of the Octopus, 'tis a pleasant thing to know,
He has a ganglion makes him blush not red, but white as snow;
And why the strange Cercaria, to go a long way back,
Wears ever, as some ladies do, a fashionable "sack;"
And how the Prawn has parasites that on his head make holes,
Ask Dr. Cobbold, and he'll say they're just like tiny soles.

Then study well zoology, and add unto your store
The tales of Biogenesis and Protoplasmic lore;
As Paley neatly has observed, when into life they burst,
The frog and the philosopher are just the same at first.
But what's the origin of life remains a puzzle still,
Let Tyndall, Haeckel, Bastian go wrangle as they will.

Punch.

Marvels of Pond Life.—VII.

NOTICEABLE currents are not always produced when the mouth of this Floscule is fully expanded. On one occasion, one having five lobes was discovered standing at such an angle in a glass trough that the aperture could be looked down into. The position rendered it impossible to use a higher power than about two hundred linear, but with this, and the employment of carmine, nothing like a vortex was seen during a whole evening, although a less power was sufficient to show the ciliary whirlpools made by small specimens of *Epistylis* and *Vaginicola*, which were in the small vessel. The density of the integument was unfavorable to viewing the action of the gizzard, but it could be indistinctly perceived. The contractions and subsequent expansions of the cup, formed by the upper part of the creature, may be one way in which its food is drawn in, but there is no doubt it can produce currents when it thinks proper. Sometimes animalcules in the vicinity of Floscules whirl about as if under the influence of such currrents. Some may be seen to enter the space between the lobes, swim about inside, and then get out again, while every now and then one will be sucked in too far for retreat.

Above the gizzard in the Horned Floscule,* I have seen an appearance as if a membrane or curtain was waving to and fro, while another was kept in a fixed perpendicular position. Mr. Gosse, speaking of this genus, observes "that the whole of the upper part of the body is lined with a sensitive, contractile, partially opaque membrane, which a little below the disk recedes from the walls of the body, and forms a diaphragm, with a highly contractile and versatile central orifice. At some distance lower down another diaphragm occurs, and the ample chamber thus enclosed forms a kind of *crop*, or receptacle for the captured prey."

"From the ventral side of the ample crop that precedes the stomach, there springs in *F. ornata* a perpendicular membrane or veil, partly extending across the cavity. This is free, except at the vertical edge, by which it is attached to the side of the chamber, and being ample and of great delicacy, it continually floats and waves from side to side. At the bottom of this *veil*, but on the dorsal side, are placed the jaws, consisting of a pair of curved, unjointed but free *mallei*, with a membranous process beneath each."

* The Horned Floscule (*F. cornuta*) which I have found, and which bred in a glass jar, were not so large as those described by Mr. Dobie, as quoted in "Pritchard's Infusoria." Mr. Dobie's specimens were 1—40″ when extended; mine about half that size, five-lobed, and with a long slender proboscis, standing in a wavy line outside one lobe. Mr. Dobie also describes an *F. campanulata*, with five flattened lobes. The "Micrographic Dictionary" pronounces these two species "doubtfully distinct." I have three or four times met with a variety of *F. ornata*, in which one lobe was much enlarged and flattened, but they had no proboscis. In what I take for *F. cornuta*, the horn or proboscis has sometimes been a conspicuous object, and at others so fine and transparent as to be only visible in certain lights.

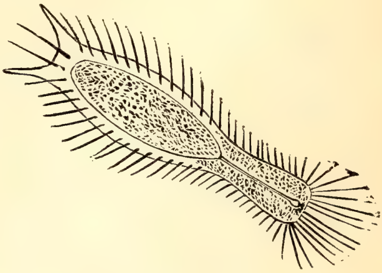
The Beautiful Floscule could always be made to repeat the process of retreating into her den, and coming out again to spread her elegant plumes before our eyes, by giving the table a smart knock, and her colors and structure were well exhibited by the dark-ground illumination, which has been explained in a previous page.

An object like this should be watched at intervals for hours and even days, especially if the eggs are nearly ready to give up their infantile contents. This was the case with the specimen described, and after a few hours a young Floscule escaped, looking very much like a clumsy little grub. After a few awkward wriggles the new-born baby became more quiet, and on looking at it again at the expiration of seventeen hours, it had developed into the shape of a miniature plum-pudding, with five or six tiny lobes expanding their tufts of slender hair. unforunately its further proceedings were not seen, or it would have been interesting to note the growth of the foot, and the formation of the gelatinous tube, which is probably thrown off in rings.

To view the details of the structure of a Floscule, it must be placed in a live box or compressorium, and if specimens are scarce, they should not be allowed to remain in the limited quantity of water those contrivances hold, after the observations are concluded, but should be carefully removed, and placed in a little vial, such as homœopathists use for their medicine. By such means an individual may be kept alive for many days. It is also interesting to place a little branch of the plant occupied by Floscules or similar creatures, in a glass trough, where they may be made quite at home, and their proceedings agreeably watched by a one-inch or two-thirds power. These troughs,* which can be obtained of the optician, should be of plate glass, about three inches long, nearly the same height, and about half an inch wide. If narrower, or much taller, they will not stand, which is a great inconvenience. The pieces of glass are stuck together with marine glue, and a very simple contrivance enables the plants or other objects to be pressed near the front, and thus brought into better view. A strip of glass, rather narrower than the width of the trough, is dropped into it, and allowed to fall to the bottom. Then a piece of glass rather shorter than the trough, and rather higher than its front side, is placed so as to slope from the front of the bottom towards the back at the top. The piece of glass first dropped in keeps it in the right position, and the trough is thus made into a V-shaped vessel, wide at the top and gradually narrowing. Any object then placed in it will fall till it fits some part of the V, where it will remain for observation. A small wedge of cork enables the movable piece of glass to be thrown forwards, until it assumes any angle, or is brought parallel to the front of the trough.

A power of five or six hundred diameters generally enables a movement of small globules to be seen at the extremity of the lobes of the Floscule, and the gizzard may be made plain by dissolving the rest of the creature in a drop of solution of caustic potash. It also becomes more visible as the supply of food falls short. Mr. Gosse describes the body as "lined with a yellowish vascular membrane," and young specimens exhibit two red eyes, which may or may not be found in adults. When these eyes of Rotifers are not readily conspicuous, they must be sought for by opaque illumination, or by the dark-ground method which, especially with the parabola, is successful in bringing them out.

Naturalists, and possibly the specimens also, do not always agree in the number of lobes assigned to the "Beautiful Floscule," and although it is easy enough to count them in *some* positions, the observer may have to exercise a good deal of patience before he is certain whether they are five or six. For a long evening only five could be discerned in the specimen now described, but the next night six were apparent without difficulty or doubt. The hairs also will not appear anything like their true length or number, unless the object glass is good, and great care is taken not to obscure them by a blaze of ill-directed light.

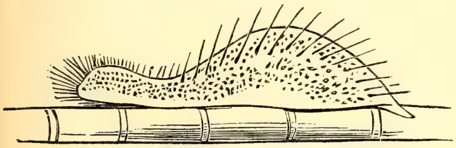


Chætonotus larus (swimming) × 520.

After the Floscules had been sufficiently admired and put aside, for observations to be repeated on future occasions, a Rotifer attracted attention by his merry-andrew pranks, throwing himself in all directions by means of two long and ex-

*The shallow cells with thin sliding covers devised by Mr. Curteis (of Baker's), are still more convenient when no pressure is required, and the objects are small. When not under the microscope they can be kept full of water by immersion in a tumbler.

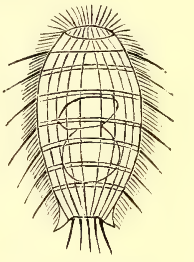
tremely mobile toes attached to his tail-foot. Then came a creature swimming like an otter, thrusting his head about on all sides, and looking much more intelligent than most of his compeers of the pond. Looked at vertically, he was somewhat slipper-shaped, the rounded heel forming his head, then narrowing to a waist, and expanding towards the other end, which projected in a fork. All round him were long cilia, which were conspicuous near the head, and a fine line indicated the passage from his mouth to the stomach, which seemed full of granular matter. Presently he took to crawling, or rather running, over a thread of conferva, and then his back was elegantly arched, and his cilia stood erect like the quills of a porcupine. This was the *Chœtonotus larus.*



Chætonotus larus (crawling) × 520.

In Pritchard's "Infusoria," the views of those writers are followed who rank this animal amongst the Rotifers, and place it in the family *Icthidina.* To help out this theory, the cilia upon the ventral surface are imagined to form a "band-like rotary organ;" but in truth they bear no resemblance whatever to the so-called wheels of the ordinary Rotifers, nor is there anything like the gizzard which true Rotifers present. Ehrenberg treated it as a Rotifer, and Dujardin placed it among the Infusoria, in a particular class, comprehending symmetrical organisms. The "Micrographic Dictionary" remarks that its "structure requires further investigation,"* and while the learned decide all the intricate questions of its zoological rank, the ordinary observer will be pleased to watch its singular aspect and lively motions. Its size, according to the "Micrographic Dictionary," varies from 1–710″ to 1–220″, and while its general proceeding may be watched with an inch or two-thirds object glass, and the second eye-piece, a power of five hundred linear (obtained by a quarter or a fifth) is required to make out the details of its structure. If placed in a live-box with threads of conferva, and a little decayed vegetation, it may be observed to grope about among them, and shake them like a dog.

We have said that water-fleas were among the inhabitants of a bottle filled at the pond, and as they go the way of all flesh, it is common to find some odd-looking animalcules ready to devour their mortal remains. These are creatures shaped like beer-barrels, upon short legs, and which swim with a tubby, rolling gait. Looking at one of these little tubs lengthwise, a number of lines are seen, as though the edge of each stave projected a little above the general level, and transverse markings are also apparent, which may be compared to hoops. This is the *Coleps hirtus*, which differs from the usual type of Infusoria, by being symmetrical, that is, divisible into two equal and similar halves. The dimensions of this species vary from 1-570 to 1-430, and its color varies from white to brown. It has been observed to increase by transverse self-division, and has two orifices, one at each end, for receiving food and ejecting the remains. It often requires some little trouble to get a good view of the cilia, which are arranged in transverse and longitudinal rows. A power of one hundred and fifty linear is convenient for viewing it in motion, but when quiet under pressure, one of five or six hundred may be used with advantage.



Coleps hirtus.

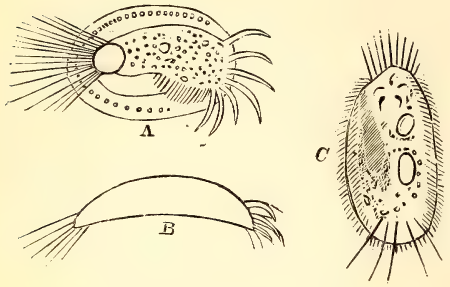
Among the rubbish at the bottom of the bottle, in which the coleps was found, was a minute dead Rotifer, the flesh of which was fast disappearing, but upon being examined with a power of nine hundred and sixty diameters, it was observed to swarm with extremely minute *vibriones*, the largest only appearing under that immense magnification like chains of bluish-green globules, not bigger than the heads of minikin pins, while the smallest were known by a worm-like wriggling, although their structure could not be defined. These *vibriones* are probably members of the vegetable world, and they always appear when animal matter undergoes putrefaction.

M. Pasteur has brought forward elabor-

* See a valuable paper by Mr. Gosse, "History of the Hairy-backed Animalcules," Intellectual Observer, vol. v., p. 387, in which the known species are described and reasons given for following Vogt and ranging them with the Turbellarian worms.

ate experiments to show that the development of the yeast plant is an act correlative to alcoholic fermentation, and in like manner the growth of *vibriones* may stand in correlation to putrefactive decomposition.

Ehrenberg considered them animals,



A, Euplotes (patella); B, side view of ditto; C, Stylonichia.

and fancied he detected in them a plurality of stomachs; but the vegetable theory is the more probable, at any rate of the species under our notice, which is often seen, though not always so minute.

At this time two interesting animalcules were very plentiful—the *Euplotes patella*, and *Stylonichia*, both remarkable as exhibiting an advance in organization, which approximates them to the higher animals. In addition to cilia they possess *styles*, which take the place of the limbs of more elaborately-constructed creatures, and give a variety to their means of locomotion. The *Euplotes* is furnished with an oval carapace covering the upper surface, which in different individuals, and probably at different ages, exhibits slightly varied markings round its margin, which in the specimen drawn above consisted of dots. They can run, climb, or swim, and exemplify a singular habit which several of the infusoria possess, that of moving for a little time in one direction, and then suddenly, and without any apparent cause, reversing it. If the reader is fond of learned appellations, he can call this *diastrophy*, but we do not know that he will be any the wiser for it.

The Stylonichia are oval animalcules, surrounded by cilia, and having moreover a collection of styles, both straight and curved, the latter called *uncini*, or little hooks. They swim steadily on, and then dart back, but not so far as they have advanced, and may be seen to keep up this fidgety motion by the hour together. Pritchard tells us Ehrenberg found that a single animalcule lived nine days; during the first twenty-four hours it was developed by transverse self-division into three animals; these in twenty-four hours formed two each in the same manner, so that by self-division only (without ova), these animalcules increased three or four-fold in twenty-four hours, and *may thus produce a million* from a single *animalcule in ten days*. Such are the amazing powers of reproduction conferred upon these humble creatures, powers which are fully employed when the surrounding circumstances are favorable, and which, in the aggregate, change the condition of large masses of matter, and bring within the circle of life millions upon millions of particles every minute of the day.

Cultivating the White Water Lily.

IN the superbly kept gardens of Europe, the aquarium or tank for water plants is an important feature, and adds greatly to the beauty of the grounds. But even where the premises are small a well kept water tank, on a much larger scale than the ordinary parlor aquarium, is a very pleasing object, and we have many attractive plants which would render them very interesting and beautiful—for example, the arrow head, the calla and others.

Many of our readers will ever hold in remembrance the sweet fragrance of the white water-lily, so common in every clear, quiet country pond. If they only knew how easily it could be cultivated, we believe that very many of them would prepare and be quite as proud of their water-lilies as of any other of their floral premises. The roots may be easily obtained from the dealer's and sent by mail, packed in damp moss. The roots should be kept constantly moist until planted.

To do that take an old tub or barrel sawed in two, that will hold water, set it either on top or in the ground, one-third filled with a mixture of garden soil, sand and well-rotted manure. The roots should be set in this mixture, and water added in small quantities, so as not to disturb the earth until the tub is filled. Very soon the handsome round leaves, four or five inches in diameter will make their appearance and fill the tub. The loss of water by evaporation should be made good from time to time, and ere long the blossoms will appear and delight everyone with their beauty and fragrance. Care should be taken not to allow the annual increase to crowd the vessel, or the floral display will be diminished. The pure white flowers will be as perfect and beautiful and fragrant as the camellia, closing at night and opening in the morning. The bloom of lilies thus transplanted are generally a little smaller than in their native pond, but this is an advantage rather than an objection.

THE

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Correction.

BY an unfortunate accident Fig. 5, page 20, in our last issue was turned upside down. As we shall have this error corrected in the electrotype plate, future impressions will be correct. To find out whether the cut is right side up or not, compare it with Figures 1 and 3, which are correct in all editions of the YOUNG SCIENTIST.

Workshop Receipts.

THIS is a closely printed volume of 450 double column pages, forming a complete encyclopædia of practical information for the amateur and the mechanic. It is too well known to need commendation. We have a few copies on hand which we offer as premiums to those who send us ten new subscribers to the YOUNG SCIENTIST and five dollars. Almost any boy can secure this number of new names by a little effort among his friends.

Astronomy for April.

SOME of our readers may miss the astronomical article in this number. The astronomy for March will be found in the February number, and as the April number will go to press early in March it will be in ample time to place in the hands of all our readers the astronomy for April.

Postage Stamps.

WE again call the attention of our subscribers to the fact, that while we take postage stamps of small denominations at full value, those of higher denominations are of no use whatever to us. We cannot sell them, except at a very great loss, and the post office will not exchange them for smaller denominations. Therefore, please do not send them.

Who Wants a Rifle?

WE have a very fine little Flobert rifle, the bore of which has been rifled so that it shoots with great accuracy. (The ordinary Flobert rifles are all smooth bores.) It is just the thing for small game or target practice, and we will give it to the first that sends us a club of fifty subscribers to the YOUNG SCIENTIST. Remember, this weapon will be given to the first that completes a club of fifty ; after that, those who wish a rifle as a premium, will have to be satisfied with the ordinary weapon.

Correspondence.

Snow Crystals.

Ed. Young Scientist—For the past two years I have been making crystals a study, and have made observations on nearly all the snow storms, but the storm of February 4, in this part of Pennsylvania, was something unusual. The storm from beginning to end was noticeably very fine. Close examination with microscope revealed that these small flakes were all solid crystals, six sided prisms, with a hexagon plate on each end, giving them the appearance of a dumb-bell. Although this form of crystal is nothing new, still in the two years of my observation I have never before discovered one until then, when they seem to come all at once.

W. T. ALAN.

Greenville, Pa., Feb. 14th, 1882.

BOOK NOTICES.

Practical Microscopy. By George E. Davis, F.R.M.S., F.I.C., F.C.S. Illustrated with 257 Woodcuts and a Colored Frontispiece. Price, $3.00. For sale by Industrial Publication Co., 14 Dey street, New York.

This work has just been issued in London, and forms a handsome small 8vo. of 335 pages. The author states that his "object in presenting this work to the student of microscopy is to supply, at a reasonable cost, a book written upon somewhat similar lines to Quekett's 'Practical Treatise on the Use of the Microscope,' the second and last edition of which appeared in 1852." Unfortunately for the author's accuracy of statement, the second edition of Quekett's work was not the last. The third, with considerable improvements, appeared in 1855. It is evident, therefore, that Mr. Davis has not made a very careful study of his proposed model. This, however, is a matter of trifling consequence, as it would hardly be worth while at this day to follow Quekett's work closely as a model.

That there is an urgent demand for a thorough work on the use of the microscope and the preparation and mounting of objects, is pretty generally felt. We hardly think, however, that the present volume quite realizes the necessary conditions, for, although three times the price, it really does not contain more matter than some dollar books now in market—the type being large and the lines double-leaded. Besides this, the work is largely made up of extracts from periodicals and catalogues (not always acknowledged), and there is a want of accuracy which is to be regretted. Thus, Tolles' address is still Canastota, instead of Boston; the vertical illuminator of Prof. H. L. Smith is credited to Powell & Lealand, and Beck; the searcher for diatoms is directed to examine the stomachs of "fish, especially crustaceans and molluscs;" and the student is cautioned against attempting to make preparations of skin, tongue, liver, lung, etc., until he has become a moderately expert experimentalist—advice which bears almost too great a resemblance to the old lady's caution not to go near the water until the art of swimming had been learnt. We are glad to see that the author has carefully read "How to Use the Microscope," as several unacknowledged passages and figures show.

But notwithstanding the somewhat unsatisfactory nature of the book, it contains enough matter, which can only be otherwise found in scattered form, to make it a welcome addition to the libraries of most microscopists.

Cleaning Engravings.

The following directions for cleaning engravings we find in several exchanges, all claiming it as original: If brown spots and rings of mildew have not made their appearance, float the engraving face downward for 24 hours on a large quantity of water, in a vessel perfectly free from grease and soil of all kinds. Lift it from the water on a perfectly clean sheet of glass, drain, transfer to blotting paper without touching it, then transfer to fresh blotting paper, dry, rub with bread, as is done in drawings, and iron. If the stains are bad, or are not removed by this plan, place the engravings in a shallow dish, and pour water over them until perfectly soaked. Carefully pour off the water and replace it with a solution of chloride of lime (1 part liq. calcis chlorate to 39 parts water). As a rule the stains disappear as if by magic. If not, pour on the spot pure liq. calcis chlorate; if that does not succeed, add a little acid nitro-hydro-chlor. dil. As soon as the stain disappears, wash the engraving carefully with successive portions of water until all the chlorine is removed. Then steep it in a weak solution of glue and gelatine, which may be colored with coffee grounds, to give the engraving a yellow color. Then dry between blotting paper, under a weight, and iron, with a sheet of clean paper between the iron and the print. Small grease spots may be removed by putting powdered French chalk over them, a piece of clean blotting paper over the chalk, and a hot iron over that. If the stains are larger, benzine must be used, applying it in a circle around the stain before touching the stain itself.

Iridescent Copper.

A new invention for coating iron and steel with iridescent copper, says the *Revue Polytechnique*, is the work of Dr. Weil, of Paris. First, 35 parts of crystallized sulphate, or an equivalent amount of any other salt of copper, are precipitated as hydrated oxide, by means of caustic soda or some other suitable alkaline base; this oxide of copper is to be added to a solution of 150 parts of Rochelle salts, and dissolved in 1,000 parts of water; to this 60 parts of best caustic soda, containing about 70 per cent. NaO, is to be added, when a clear solution of copper will be formed. The object to be coppered is to be cleaned with a scratch-brush in an alkalino-organic bath, attached as a cathode, immersed in the coppering bath, and treated with the usual precautions, when it will become rapidly coated with an adherent film of metallic copper. As the bath gradully loses its copper, oxide of copper, as above prepared, should be added, to maintain it in a condition of activity, but the quantity of copper introduced should not ordinarily exceed that above prescribed, as compared with the quantity of tartaric acid the bath may contain. If the quantity of copper notably exceeds this proportion, certain metallic irisations are produced on the surface of the object. These effects may be employed for ornamental and

artistic purposes. According to the time of the immersion, the strength of the current and the proportion of copper to the tartaric acid, the iridescences may be produced of different shades and tints, which may be varied or intermingled by shielding certain parts of the object by an impermeable coating of paraffine or varnish, while the iridescent effect is being produced on the parts left exposed. All colors, from that of brass to bronze, scarlet, blue, and green, may thus be produced at will.—*Metal Worker.*

An Artificial Sun.

The most powerful artificial light in the world has just been constructed by Messrs. Chance Bros. & Co., at Smethwick, near Birmingham, Eng., for the South Head Lighthouse, near Sydney, New South Wales. It is a first order dioptric, revolving light, with the electric arc. The lamp has a special arrangement of prisms for securing vertical divergence of the beam. It is over six feet in diameter, and the height is about nine feet, and it is said to be the first time such dimensions have been applied to illumination by the electric arc. The lamp has a power of about 12,000 candles in the focus of light, and the merging beam has a luminous intensity exceeding 12,000,000 candles. The light will give flashes around half the horizon at intervals of a minute, and will make a complete revolution every 16 minutes. On an average, the light will be visible at a distance of 40 to 50 miles. At an exhibition of its power recently given at Smethwick, the light was so intense that it oould hardly be endured by the naked eye.

Iridium for Electric Lamps.

A promising improvement has been made in electric lighting by substituting electrodes of iridium for the carbon pencils hitherto almost exclusively used as poles in exhibiting the voltaic arc. Iridium is fusible only in the arc from a very powerful battery, and by keeping the intensity of the current below a given point, the metal can be maintained at a temperature of about 4,000° F., which is far below its melting point, though high enough to add the light of an intense incandescence to the brilliancy of the arc itself. At this temperature the iridium points remain completely unchanged, and the variations and flickerings due to the rapid wearing away of carbon pencils are entirely absent in the new light; while the consistency with which the source of illumination keeps its place peculiarly adapts it for use in the focus of the Fresnel lenses, or the parabolic reflectors which, in lighthouses, or in similar situations, take their place. The process by which the iridium, naturally a gritty and intractable powder, is formed into pencils for use in lamps is an ingenious adaptation of a patent issued long ago for making the same metal into points for gold pens, and depends upon the property which iridium possesses of forming a compound with phosphorus, which can then be melted at a temperature of about 3,000° F.—about the fusing point of iron—and molded into masses which can be subsequently dephosphorized, and regain the original infusibility of the pure metal.

The Largest Refracting Telescope in the World.

For the present our friend, Alvan Clark, is outdone by his Hibernian rival, Howard Grubb. The 26-inch refractor at Washington, the largest previously made, must yield the palm to the 27-inch one lately finished at Dublin for the Royal Observatory at Vienna.

It is a curious fact that the Emerald Isle should have produced the largest refractor as well as the largest reflector, which our readers are aware is Lord Rosse's. The former was ordered by the Austrian Government in 1875, and the mechanical portions of the instrument were nearly finished in 1878. The making of the object-glass was delayed by the difficulty of getting perfect material. Messrs. Feil, of Paris, furnished several sets of glass discs for the purpose before any were found free from flaws and defects. Much time and labor were lost in working some of these discs into such shape that their imperfections could be detected. It was not until March of the present year that the instrument was complete in all respects, and its performance approved by the commissioners appointed by the Austrian Government to test it.

The tube of the telescope is made of steel plates riveted together, and measures 33½ feet in length, with a diameter of 36½ inches in the middle, tapering to 27 inches at one end and 12 at the other. The weight of the tube with its attachments is between six and seven tons, but the whole weight can be easily moved by the observer with one hand. The great dome in which the telescope is to be placed is also of steel, consisting of a double shell of thin plates with light ribs and girders between, the whole forming a cellular structure somewhat like that of the top and bottom of the Britannia Tubular Bridge. Great strength and stiffness are thus secured, while the weight is reduced to the minimum. The dome, 45 feet in diameter, weighs only about fifteen tons, and when set up on temporary supports at Dublin could be moved round with a tractive force of seventy

pounds. It will probably "work" even more easily in its proper position at Vienna.—*Boston Journal of Chemistry.*

Nicknames of the States.

The following are some of the nicknames of the States:

Alabama, Lizard State; Arkansas, Tooth-pick; California, Golden State; Colorado, Rover; Connecticut, Wooden Nutmeg; Delaware, Musk-rat, otherwise the Blue Hen's Chicken; Florida, the Beaver State; Illinois, Sucker; Indiana, Hoosier; Iowa, Hawk-Eye; Kansas, the Jay-Hawker; Kentucky, Corn Cracker; Louisiana, Creole; Maine, Fox, otherwise Lumber; Maryland, Gray Vampire; Michigan, Wolverine; Minnesota, Gopher; Mississippi, Tadpole; Missouri, Puke; Massachusetts, Bay State; Nebraska, Big Eaters; Nevada, Sage Hen; New England, Land of Steady Habits; New Hampshire, Old Granite; New Jersey, Blue, sometimes Clam Catcher; New York, Knickerbocker or Empire; North Carolina, Old Tar; Ohio, Buckeye; Oregon, White Foot, or Hard Case; Pennsylvania, Broadbrim, or Keystone State; Rhode Island, Gun Flint; South Carolina, Palmetto, or Weasel; Tennessee, Whelp; Texas, Beef-Head; Vermont, Green Mountain; Virginia, Pitch; Wisconsin, Badger.

French Polishing.

Dissolve shellac in spirits of wine, with the aid of heat, till it is about as thick as cream. Make a ball of cotton wool, with a bit of soft rag over it. On this pour a few drops of polish; cover with another bit of soft linen rag, on which put one drop of raw linseed oil; hold this against the work as it revolves in the lathe until dry, moving it to and fro all the time; repeat the process till the work shows a polish; then, with a rag on which is just a drop or two of spirit of wine, or with the same rubber, on which is a drop or two of spirit, go over it again till it is all bright, with no smears. If not lathe work, you will have to rub round and round in circles over the surface, never stopping, but taking up the rubber *en route* generally; the best way is, with the last circling motion, to sweep it clear of the work. It is a laborious job if on a large surface, especially as the polish will at first sink in, and when you next inspect it you will find it terribly fallen off from its pristine beauty. You should let it then get dry and hard, and, with the very finest No. 00 sandpaper, rub it down to a general smooth, but, of course, wholly unpolished face. Then go at it again. Do not use much oil, only enough to prevent the rag sticking in its course. For the last coats use the finish thinner. The object of the rub with the spirit only is to get rid of dull spots caused by the oil, and to insure a very thin coat of polish; some oil the work first, and let this soak in for some days till dry, then polish. It will be found that the less oil the better.

Bullet Holes in Windows.

Dr. Balch, in his review of the medical evidence given on the second trial of Jesse Billings, Jr., says that a ball fired from a rifle through a window pane will make a hole one-third smaller than the ball itself. He has proved this by repeated experiments. He dwells on this at some length; but after all it was a fact that was fully known and discussed as long ago as the time when Jesse Strang shot Mr. Whipple through a window in the old house at Cherry Hill.—*Albany Evening Times.*

Practical Hints.

Improved Starch Polish.—Spermaceti, 1 part; gum arabic, 1 part; borax, 1 part; glycerine, 2½ parts; water, 21½ parts; and a sufficient quantity of perfumed alcohol to produce an emulsion. About three teaspoonfuls of this emulsion are required for about one-quarter of a pound of starch.

Bronzing Copper.—At the Paris mint, medals are bronzed by boiling them for a quarter of an hour in the following solution: pulverized verdigris, 500 grammes; pulverized sal-ammoniac, 475 grammes; strong vinegar, 160 grammes; water, two liters. An untinned copper boiler is used, and the medals are separated from each other by bits of glass or wood.

Black Dye for Wood.—The following new process is published in the *Pharmaceutische Zeitschrift fur Russland:* First sponge the wood with a solution of chlorhydrate of aniline in water, to which a small quantity of copper chloride is added. Allow it to dry, and go over it with a solution of potassium bichromate. Repeat the process twice or thrice, and the wood will take a fine black color, unaffected by light or chemicals.

Amber Varnish.—Amber varnish is usually prepared by roasting the amber and adding hot linseed oil, after which turpentine can be mixed if required. But if small quantities are required you might proceed as follows:—Dissolve the broken amber, without heat, in the smallest possible quantity of chloroform, or pure benzine. Heat the linseed-oil, remove it from the fire, and pour in the amber solution, stirring all the time. Then add the turpentine. If not quite clear, heat again.

Treatment of Hydrofluoric Acid Wounds.—A. E. Robinson writes to the editor of the *Chem. News* that one of his assistants had been seriously burned by hydrofluoric acid, the face

wounds being very severe and deep, and that he has treated them first with a paste of chalk and water, and afterwards with a mixture of chalk and olive oil. The latter mixture allayed the pain and suffering considerably, and materially hastened the healing process, the face-wounds being now healed over, forming a perfectly healthy skin,

Paper for Silver-Ware.—The *Archiv der Pharmacie* gives the following formula for making paper for wrapping up silver: Six parts of caustic soda are dissolved in water until the hydrometer marks 20° Baume. To the solution add four parts of oxide of zinc, and boil until it is dissolved. Add sufficient water to bring the solution down to 10° Baume. Paper or calico soaked in the solution and dried will effectually preserve the most highly-polished silver articles from the tarnishing action of the sulphuretted hydrogen which is contained in such notable quantities in the atmosphere of all large towns.

Cleaning Lime-Encrusted Pipes.—A correspondent of the *American Manufacturer* writes: "As a sort of 'shop kink' I give you a curious experiment tried on an engine water-supply pipe that had become choked up with lime encrustation. After hammering it for an hour or two, and kindling a fire all over it, without any result, one end was plugged up, and about a pint of refined coal oil was poured in the other—all it would hold—leaving it to stand all night. The next morning the entire mass slid out, a solid lime core. Before trying this we thought of throwing the pipe away as useless, and getting a new one."

Blacking Brass.—A correspondent of the *English Mechanic* says: I have tried all the various recipes recommended—nitrate of silver, platinum bichloride, etc.—but never found any work so satisfactorily and cheaply done as by the reduction of nitrate of copper to the oxide. I find the best way of using is to apply the solution to the brass to be blacked with a camel-hair brush, previously slightly heating the metal; then to raise the heat until the requisite color is produced; finishing by rubbing with a soft rag, and either oiling or lacquering. I can confidently recommend this as the very best method of producing that good black seen in first-class optical goods, observing that the process will not do for soft-soldered articles, as the heat necessary to produce the black is greater than the melting-point of soft solder.

Damascus Steel.—Perhaps one of the best methods which have ever been discovered for tempering steel, resulting in hardness, toughness, and elasticity combined, is that followed in hardening the blades of the famous Damascus swords. The furnace in which the blades were heated was constructed with a horizontal slit by which a current of cold air from the outside entered. This slit was always placed on the north side of the furnace, and was provided on the outside with a flat funnel-shaped attachment by which the wind was concentrated and conducted into the slit. The operation of tempering the blades was only performed on those days of winter when a cold strong north wind prevailed. The sword-blade when bright red hot was lifted out of the fire and kept in front of this slit and by this means was gradually cooled in the draft of air. It acquired the proper degree of temper at the single operation,

QUESTIONS AND ANSWERS.

How can I bronze plaster casts? A. B. C.

Ans.—The plaster must first be rendered non-absorbent by filling the pores with size. When this is dry, give a very light coat of gold size or boiled linseed oil, and when this has become nearly dry, but is still sticky, dust bronze powder over it. When the whole is thoroughly dry, dust off the loose powder with a brush, especially from the crevices and projecting points.

Will some one tell me how to make a stereotype of a line of type?

Ans.—Lock up the line of type, as if for printing, and oil the surface with any kind of oil, which must, however, be carefully wiped off, merely leaving the surface greasy. Pour over it a cream of plaster-of-Paris and water, such as is used for taking casts, and when this has become hard, lift it off and dry it at a temperature not higher than that of boiling water. Make another plaster cast with a perfectly smooth face, dry it also, and tie the two together. See that the plaster moulds are quite dry, or you will have trouble. Make a sprue or channel like that through which the lead is poured into a bullet mould, but much longer, so as to give a good "head" of metal. This will force the metal into all the fine lines and keep it free from air bubbles. Then melt some stereotype metal (old stereotypes are best for amateurs) in a ladle and pour it into the mould. When cold, dress up the casting and fasten it on a block.

Angle-Worms and St. Elmo's Fire.—You will confer a favor on us by answering the following questions: "How do angle-worms dig their holes?" and "What is the St. Elmo Fire?"
P.S.—We do not know what angle-worms are.

Ans.—Several species of worms are known as "Angle-Worms," but the term is generally applied to the common earth worm. They can hardly be said to "dig" holes, but the means by which they penetrate the ground is singularly interesting. Between the particles of earth they insert the very fine end of their lip, which they are able to draw out to a very long and slender thread. This is armed with spines, so that it cannot be drawn back, except at the will of the animal. As soon as the front part of the animal has been fairly embedded it is made to swell up and enlarge the hole sideways, and the mucus or slime given off by the animal, cements the sides of the hole and makes it smooth. In soft ground this process is repeated rapidly, but where the soil is very hard the operation is a slow one. Still, it is only a question of time even in the hardest ground.

St. Elmo's fire is the silent discharge of electricity from the clouds upon an elevated point, It appears as a luminous brush upon masts and spires, especially where these are furnished with metal points, such as weather vanes, etc.

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Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

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Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

Blow-pipe set (cost $10), large illustrated family Bible (cost $7.50), for Wood's Botany, Dana's Geology, or printing press and type. H. W. Noble, Box 134, South Dansville, N. Y.

Wanted, offers for fossil shells from the west coast of Africa. A. W. Seward, 187 E. 71st St.

I have a number of birds' eggs I should like to trade for other birds' eggs; send for list of trading eggs. A. G. G., Box 26, Summit, New Jersey.

For a microscope stand or offers, a 36-inch turning lathe (new) and a number of scientific books; send for list. A. Kendall, Somerville, Mass.

Wanted services of amateur printer with small office (or large), in exchange for an interest in a well-established weekly paper, good size. Eagle Office, Plymouth, N. H.

American Agriculturist microscope, new, cost $15, for amateur photographic apparatus, lever watch, 22 calibre breech-loading sporting rifle or magic lantern of equal value. Wm. A. Walker, Rockland, R. I.

I. T. Bell, Franklin, Pa., has back numbers of Scientific American, Forest and Stream, and Young Scientist, good flute, chessmen, books, etc., for good magic lantern, revolver, scarce coins, or offers.

A steel spring bracket-saw, 2 doz. saw blades, and about 1 doz. patterns for a good stylographic pen or offers; send postal before exchanging. Geo. Oakley, Rutherford, N. J.

A new 40 diameter microscope, corals, and minerals, for a stylographic pen, air gun, or offers. J. McBride, 54 Garley St., Chicago.

A rosewood banjo, 11 inch head, 12 nuts, fully strung, together with lot of dime banjo music and instructions, for microscope, Webster's Unabridged, monkey, squirrel and cage, or offers. J. DeWitt Clark, P. O. Box 37, Brooklyn, N. Y.

For self-inking printing press and type, one Henry rifle, 16 shot, 44 cal., cost $40, in good order, or one double barrel shot gun, barrels London fine twist, or offers. J. B. Garrison, Belton, Bell Co., Texas.

What offers for "The Chefs D'Oeuvre D'Art, Paris Exhibition 1878," cost $16, good as new, bound; 1 large photo camera, complete, cost $95; Scientific American from 1859 to 1880, 4 vols. bound. D. Keesler, Stony Point, N. Y.

Sea shells of Atlantic coast, scientifically marked, for books, old or new magazines, Indian relics, natural history specimens, apparatus; anything. Wilfred Leon Miller, P. O. Box 392, Cape May, N. J.

A dulcimer that cost $20, books and fossils, for a telescope, microscope, fossils, Indian relics, or offers. E. J. Votaw, Salem, Iowa.

A self-inking model press, 5 x 7½, cost $23; $90 worth of scroll-saw designs in lots to suit; Scientific American, 1880; Palliser's Useful Details, $3; for photo outfit or offers. C. H. Parker, Coldbrook Springs, Mass.

Telegraph key and sounder, Frank Leslie's Illustrated Magazines, mounted microscopic objects, natural curiosities, for bull's-eye condenser, photograph camera, Unabridged Webster Dictionary, or offers. W. T. Alan, Greenville, Mercer Co., Pa.

Large magic lantern, spectroscope, pantagraph, for enlarging drawings, rosewood writing desk, man's saddle, for microscope, photo outfit or offers. Thomas Walters, Bergen St., East of Brooklyn Ave., Brooklyn, N. Y.

Model card press, chase 3¼ x 5¼, with 4 fonts type, cases, etc., for good foot lathe. Mills Day, 2 Farmington Av., Hartford, Ct.

French microscope, inclines to any angle, delicate fine motion, neat upright case, cost $17.50, for scientific books; send list to W. Fitz, P.O. Box 2852, New York.

Wanted, Quinby's New Bee Keeping, for Our Own Birds of the United States, by W. S. Baily; new. Joseph Anthony, Jr., Coleta, Whiteside Co., Illinois.

Printing type, small pica; large and small capitals, and small letters; 60 to 65 lbs., including two large cases; also gothic nonpariel, for trade. J. Siler, 1242 Broadway, St. Louis, Mo.

One years' copy of Aldine, cost $5.50, and German accordion, with instructions how to use it, cost $5.00, for offers. Chas. Dempwolf, 86 Benson St., Paterson, N. J.

A Novelty printing press, with type, prints a form 5 x 7 inches, cost $40.00, for a microscope, photographic apparatus, or offers. T. W. Patterson, Warsaw, N. Y.

$80 worth of (nearly new) printing material, minerals, fossils, Aboriginal relics, etc., for scientific books, good American watch, and offers. F. M. Farrell, Cobden, Union Co., Ills.

Rocks, minerals, fossils and fresh water shells for microscope stand, $20 to $75, also for objectives, turning lathe type, and tools. D. D. Babcock, South Dansville, N. Y.

Mechanical Electricity, Medical Chemistry, by Robert Hare; Fruits and Farinacea, by Trall; Complete Herbalist, by O. P. Brown; for mounted objects for the microscope or offers. J. B. Playter, Bristow, Butler Co., Iowa.

Violin (cost $10) and 5-shot 32-cal. revolver (cost $4), for photo-camera lens and tube, watch, parlor rifle, extra well-bred canary birds, or offers. C. Maides, St. Louis, Mo.

To exchange for a wood-turning lathe or offers, a Young America Self-inking Printing Press, with type and outfit complete; chase 3 x 5 inches. Embury McLean, 318 Bloomfield St., Hoboken, N. J.

What offers for "Our First Century," cost $7.00, bound in sheep, over 400 illustrations, 1,000 pages; also small Ruby Magic Lantern, cost $1.50. Box 217, So. Manchester, Conn.

Magic lantern, in good order, condensing lens, 2½ in. diameter, 8 slides. For small photographic camera or offers. H. A. Giddings, 4 Union Place, Classon Ave., Brooklyn.

Printing press, type, etc., worth $13, for offers. E. G. Vogeley, 1010 Bradford St., Pittsburgh, Pa.

Fifty canary birds, with and without crests; fancy poultry, conch shells, strombus alatus. For small printing press, books on natural history, or offers. Frank Lattin, Gaines, N. Y.

A good plain 7 shot revolver, 22 calibre, for a Students' inch or half-inch objective. Frank F. Colwell, Urbana, Ohio.

Wanted, Printing press and type, in good order, chase 6 x 10, or larger; will give hardware, tools, scroll saw, or designs. Chas. E. Little, 59 Fulton St., New York.

Photo outfit, tools, chemicals and apparatus, etc., etc.; wanted scientific books, apparatus, etc.; send lists. A. B. Campbell, Box 59, South Dayton, Catt. Co., N. Y.

Pens.—For pens for mercantile purposes the tendency is to use those with blunt points, leaving the extra fine and elastic for schools and professional penmen. For correspondence and rapid writing pens are enquired for that will make a distinct and bold outline without regard to shading, such as Esterbrook's Nos. 122, 183, and 1743, all having blunt points. Those with turned up points are especially suitable for the same purposes, and have a remarkable easy, quill-like action, represented by Esterbrook's Nos. 1876, 256, and 309.

Preference is given by many to the short nib or stub pens, of which the Nos. 161 (Engrossing), and 284 (Blackstone), of the same make, are the most popular.

The Young Scientist

SCIENCE IS KNOWLEDGE. KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS

VOL. V. NEW YORK, MAY, 1882. No. 5.

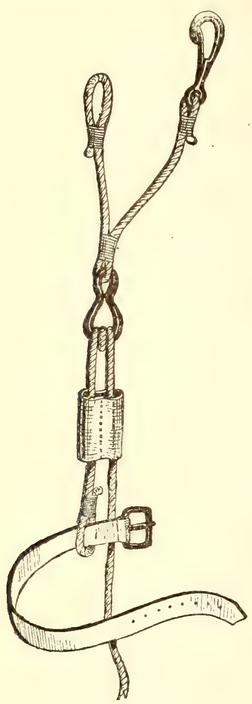
A Simple Fire Escape.

EVERY time a great fire occurs in a tall building we find either actual loss of life, or cases in which some of the occupants had a very narrow escape. It would seem that the ordinary fire escapes soon become useless, and at many of our great fires the ladders used by the firemen are entirely too short to reach the upper stories. This was notably the case at the fire in Park Row last winter (the old "World" building), where even such a well equipped establishment as the New York Fire Department had not within their command the means of reaching the upper stories of a building of comparatively moderate height. As a consequence of this state of things, numerous costly and complicated fire escapes have been invented, but the difficulty is that they are never at hand when wanted. Others have recommended the use of a simple rope, three-eighths of an inch in diameter, and knotted at intervals of fifteen inches. Such a cord, made fast to a staple or bar, would enable an active man to descend from any story, provided he did not become giddy, and his hands were not too soft. Men whose occupation is writing could hardly descend by means of such a rope. Neither could women. But by taking advantage of the great friction to which even a single turn of a rope round a rod gives rise, it is easy for even a weak woman to let herself down safely. But of course the rope must be secured to the body in such a way that its holds does not depend upon the strength of the person using it.

The simplest and most efficient arrangement is that shown in the engraving. First of all, we have, at the upper end, a short rope fastened to the eye of an iron link. This rope has a loop at one end, and a snap at the other, so that it can be fastened in a moment to the leg of a bedstead, to a staple, or to any other strong hold. The lower eye of the iron ring

is made larger, so that the main rope may go round it twice, and the two ends of this rope pass through a sleeve of light leather or heavy duck, so as to prevent entanglement. One end of the main rope has a loop through which passes a stout leather belt, long enough to go round the waist of any person; the other end is free.

When in use, the upper rope is fastened securely to the building, or to any heavy object that cannot be dragged through a window; the belt is then fastened round the waist, and the person who is to descend draws the other end of the rope



A SIMPLE FIRE ESCAPE.

tight, and holding it firmly in the hand, steps off the window sill. By easing the end of the rope that is held in the hand, we may lower ourselves as rapidly as may be desired, while at the same time a strain of a few ounces will create enough friction to support the heaviest individual.

Such a fire escape may first be used by the men to lower all women and children, and afterwards the men may descend one by one. It is so cheap and simple that any person can procure one, and it can never fail or get out of order.

Practical Hints on the Construction of the Violin—II.

LET us now suppose the materials from which we are to construct our violin to have undergone the necessary seasoning and drying process. The next thing to be done is to provide ourselves with tools. The amateur violin-maker will find this one of the most discouraging obstacles to be overcome. He will search hardware stores and tool-makers' shops in vain, and in the end will find himself under the necessity of making most of the implements he needs. We will endeavor, as we go along, to give an idea of the requisite tools, but in the absence of proper drawings, the description must necessarily be very incomplete.

We shall commence with the back or under table of the instrument. Two of the wedge-shaped pieces of maple are dressed down neatly with the plane, and then clamped firmly in the vice with their thick edges together as they grew. The thick edges are then planed down and neatly jointed. For this purpose the plane must be very sharp and accurate, or else it will be found impossible to make a good joint. When the joint is absolutely perfect, the pieces are slightly warmed, one of them is clamped in the vice, the surfaces to be joined covered with good, rather thin and hot glue, and rubbed one on the other until the glue begins to set. If the pieces rock or swim during the rubbing, it is an evidence of bad jointing, and they must be separated, the glue cleaned off with a little warm water, and a new joint made. If the joint be good the parts are allowed to remain in the vice until well set, and then put away in a dry place for at least twenty-four hours. In no case should they be clamped together, as a joint thus made is always liable to open and leave an unseemly line down the centre of the back. The two pieces which compose the belly of the instrument must be treated in the same manner as those for the back, but being

of spruce, the work of making a good joint will be found much easier.

The next operation is to prepare the sides, sidê-linings, corner and end blocks. The sides must be of the same material as the back. They are first sawn into strips about fourteen inches long, an inch and a quarter wide, and about a sixteenth of an inch thick. The side-linings are of spruce, about the same length as the pieces for the sides, a quarter of an inch wide and an eighth thick. The end blocks and corners are also of spruce; the end blocks are semicircular and of the same height as the sides; the corners when finished are almost triangular.

The next thing to be done is to lay out the shape of the instrument, and as a great deal of the tone of the violin depends on its shape, it is necessary that this part of the work be done with extreme care. The best plan for the beginner would be to select a good instrument and make his model accordingly. Having made his selection, he draws on cardboard an exact figure of the inside of the instrument he desires to copy, omitting the corners, so that the figure drawn may resemble a guitar.

This pattern he places on a plank of good hard wood about inch and a half thick, and somewhat larger than the body of his intended violin, and with a sharp pencil draws thereon the outline by closely following the cardboard pattern. He then, with a good scroll-saw, cuts out from the block a mould on which to build his instrument. If the sawing has not been well done it may be necessary to go over the work with a file until the edges are perfectly straight and the form symmetrical. The mould is then planed down to the height the sides are to be, slanting it towards the narrow or neck end until the difference is about a sixteenth of an inch. A semicircular piece is then cut out from the neck end, and another from the opposite end where the neck and tail-blocks are to be, and four small mortise-like recesses about an inch by a quarter of an inch, where the corner blocks are to be placed.

A mortise about two inches long and an inch and a half wide must now be made in the centre of the mould, and from this mortise two wedge-shaped blocks are sawn out, running lengthwise to where the neck and tail-blocks are to be. The beginner will remember that the mould was sawn from a large plank. Let him now take this plank and extend the opening from which he cut his mould about an inch all around. This will serve as a clamp when he comes to set up the sides.

It will be remembered that the mould was sawn into four pieces. These pieces must be clamped together in the following manner: Take two plates of steel and drill five holes in each, large enough to admit inch wood screws with round heads—two near each end of the plate and one in the centre. The sections of the mould should then be placed together just as they were before being separated by sawing. Mark the holes with a pencil, drill the wood to receive the screws, and screw fast. The mould is now ready for the end and corner blocks. Before inserting the blocks, the recesses should be covered with paper, which may be attached with a little glue. The blocks are then neatly fitted to the recesses and glued. When this has been done the mould is ready for the reception of the sides. The sides should be boiled in water and then bent on a hot iron into shape. Then having neatly trimmed the sides and shaved off the ends where they meet on the corner blocks, and having trimmed down the blocks to their proper shape, insert the "D" pieces, one on each side of the mould, and glue to the corner blocks. In the meantime the mould and frame should both be screwed fast to a board placed underneath, so that the sides may be held fast to the blocks by means of wedges pressed down between the mould and frame. When the "D" pieces have set, the other side pieces may be glued in their place, taking care to make a neat close joint where they meet at the larger or tail-piece end of the mould. There is no need of making a close joint at the other end, as part of the sides and block must be afterwards cut away for the reception of the neck.

The next operation is the making of the back and belly of the instrument, and as

this is the most important operation in violin making, we will reserve our remarks on it for a future essay.

(To be continued.)

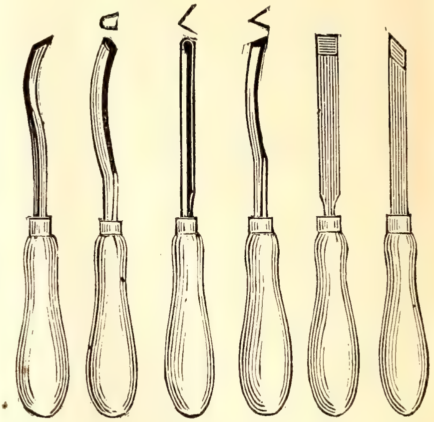
Amateur Wood Carving.

BY FRED. T. HODGSON.

TO the amateur woodworker who has never tried a hand at *wood carving*, the beautiful art seems so full of difficulties and mystery that it is rarely essayed by any but the most expert and advanced amateur workman. There is no reason why any person, who has sufficient judgment to keep edge tools in moderate order should not be able to become a fair amateur carver. Of course, no person, no matter how clever he or she may be, can reasonably expect to do even indifferent work, at the first attempt; there is no royal way by which the inexperienced may be made an adept in the art at one stroke. There is one thing, however, that is very clear to any person who knows any thing about wood-carving, and that is, that any boy who is able to write his own name in a legible manner, possesses artistic and mechanical talent enough to make an average amateur wood carver. The same thing may be said of girls, and in fact, it may be said, that as a rule, girls make finer work in this art—up to a certain point—than boys. This being the case then, there is no reason why our young friends—boys and girls alike—should not try their hands at this fascinating art, and to aid them in their efforts the following hints, suggestions and examples are offered:

The first thing to be considered is the selection of tools, and with regard to this matter let it be understood right here, that to do good work it is absolutely necessary that the appliances for doing the work must be good also. A good workman cannot make good work with bad tools; an indifferent workman may make good work if possessed of good tools.

The best carving tools are made by Addis, and although costly at first, are, in the end, cheaper than many makes now in the market. A set of nine tools suitable for amateur work would cost about six dollars, and where the magnitude of this sum is no objection, the purchase of these tools is advisible. Where this sum is too large, however, a set of amateur carving tools might be obtained, such as we show in Fig. 1. Here are six tools, and



1 2 3 4 5 6

Fig. 1.

are so made, when of good material and temper, that almost any ordinary amateur work may be executed with them. They are sold in sets just as exhibited, put up in neat boxes for from $1.10 to $1.50. The three principal tools in the set are the flat chisel (5), the gouge (3), and the veining tool (4). To use these properly requires some little practice, and the learner should begin first by securing a pine or white-wood block to his bench by screws or glue. The block should be about seven inches long, four inches wide, and one inch thick. Having the block all prepared and the tools in good order, the next step should be to prepare some simple design that may be easily worked. The one shown at Fig. 2 is well adapted to our purpose, as it embodies two kinds of work—*i.e.*, carving and punching. The light colored spaces show the raised parts, and the dotted ones the sunken parts. The dark lines on the outside edge show a bevel all round. This is made with the flat chisel, and should be carried down the edges about three-eighths of an inch, and five-eighths of an inch on the top of the block. The mitres at the corners must be true

and perfect or the work will look slovenly finished. The raised parts of the example before us stand out in relief about one-eighth of an inch, and must be finished

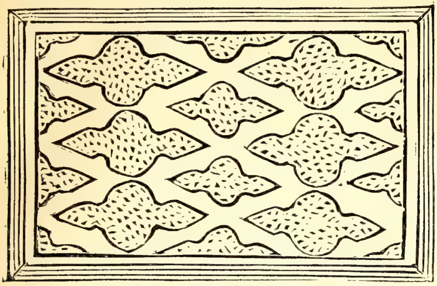


Fig. 2.

smoothly on the edges. The dotted work is formed by a series of little punches, a number of which are shown at Fig. 3, each

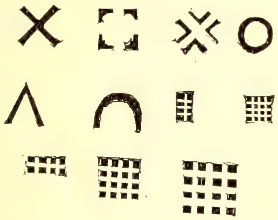


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Fig. 3.

pattern of which may be obtained at any well furnished hardware store for about twenty-five cents. No. 1 is the pattern required for the example.

To line off the raised work, take the V or parting tool, hold it in your right hand at a proper cutting angle, put your left wrist on the wood to be operated on, pass your hand over the steel, the thumb underneath, and the tips of the fingers resting on the work. This will give you perfect command of the tool; will prevent its slipping forward; enable you to guide it round the curves, and the thumb being under the tool, you can grasp it at any moment with the whole hand. Be careful and do not cut in too deep with this tool. When the pattern is well marked in the block with this tool, then the flat chisel may be used to advantage. In punching, be careful and strike short sharp strokes on the punch with a hammer, and in such a manner that each blow will have a like effect with all others on the same work. Turn the punch after each blow, so as not to give the grounding a liney or uniform appearance; and one more caution, if you see that the punch raises little chips of wood, try the other way of the grain, or turn the punch so that it will not raise the chips. A little practice with these punches will soon enable the operator to do very nice work of this sort.

This kind of carving is called diaper carving, and is very effective when properly executed.

The example shown at Fig. 2, when finished, would make a very nice lid or cover for a box, and if ends and front were executed in the same manner without beveling the edges, a very nice box for gloves, cuffs or collars might be constructed with them.

This is a very simple lesson in carving, and if the young beginner should fail in this, the first attempt, it will be no discredit, providing it does not discourage, for it must be borne in mind that most of our best carvers have not arrived at their present state of perfection without having first spoiled many a piece of good stuff. If the first attempt should prove a failure, do not be discouraged, but turn the block over and try the same pattern on the other side; be more careful this time, and success will surely crown your efforts if you will only persist.

Fig. 4 shows an escutcheon which is finished on the same principle as Fig. 2. There is a raised border all round the edge, and a few sprays on the surface are

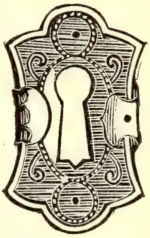


Fig. 4.

raised, the sunken part is diapered with one of the punches shown in Fig. 3. This is made of hard wood and only about a quarter of an inch thick.

Fig. 5 represents a rosette ornament, or

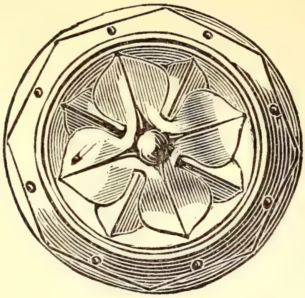


Fig. 5.

it would do very well for the end of a drawer knob. This is a very simple piece of carving in relief, and will not tax the skill of the operator very much. It is so simple that explanation is unnecessary.

The beginner must remember one thing, and that is, never to use sandpaper on carved work. All lines and angles should be left sharp and well defined, and this feature cannot exist if sandpaper is used on the work, as it will most assuredly destroy it.

We have now said sufficient to give the beginner a fair start in the art of carving, and we hope he will continue to practice it until he becomes ambitious to try his skill on something more difficult, when we will, in a future chapter, be pleased to give him further aid.

A DRIVE.

BY MARY H. WHEELER.

Up from her cavern a water-sprite came
For a drive on the moonlighted lake,
And her transparent garments, all bright as a flame,
Left a luminous trail in her wake.

Her car was a diatom, shapely and strong,
Which shone iridescent in gleam,
And with bands of conferva she guided along
Her tandem-hitched rotifer team.

As, rearing and plunging, her steeds with a dash
Went rapidly circling by,
Through the sparkling water she went like a flash
Of electrical light from the sky.

The Daphnia held up her hands in surprise,
"My eye!" cried the Cyclops, "that's gay!"
And the Hydrachna winked with her two pairs of eyes,
While the Cypris went swimming away.

But alas for this turnout so jaunty and nice!
When the moon marked the full midnight hour,
A trout gobbled up the whole team in a trice,
And the water-sprite fled to her bower!

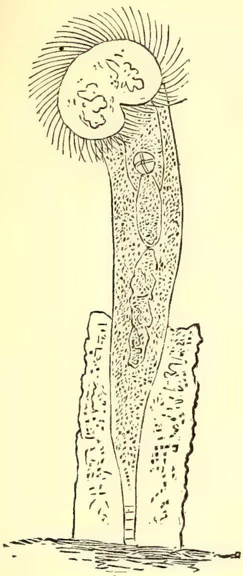
Pittsfield, N. H.

Marvels of Pond Life.—IX.

As usual the Kentish Town ponds were productive of objects, and among them were several rotifers not found previously. The first of these was a very small worm-like thing, with one eye, a tuft of cilia about the mouth, and two toes at the tail end. Had it not been for the jaws, which were working like fingers thrust against each other, and which were unmistakably of the Rotifer pattern, the animal might have been supposed to belong to some other class. According to the "Micrographic Dictionary," the *Lindia torulosa* is 1-75″ long, but this specimen was only about 1-200″. It was possibly very young, and did not thrust out its cilia in two distinct tufts, as Cohn describes, although it may have had the power of doing so. At times it sprang quickly backwards and forwards, bringing its head where its tail was before. This object required for its comfortable elucidation a power of about six hundred linear.

Among the common water plants, which are worth examining as the probable abodes of rotifers or infusoria, is the pretty little thing called "star-weed," some of which was obtained from the last-mentioned ponds, and on examination yielded a specimen of a tube-dwell-

ing rotifer, the *Œcistes crystallinus*, which, although less beautiful than the Floscules or the Melicerta, is, nevertheless, a pretty and interesting object. In this instance a little rough dirty tube, about 1-70″ long, was observed to contain an animal capable of rising up and expanding a round mouth garnished with a wreath of cilia; while a little below, the indefatigable and characteristic gizzard

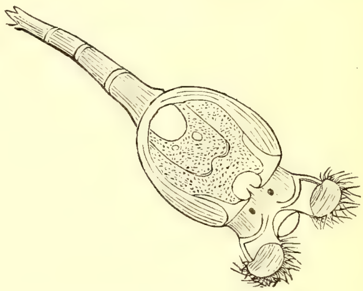


Œcistes crystallinus. × 240.

of the tribe was in full play. A power of two hundred and forty linear sufficed to afford a good view, and it was seen that a long, irregular, conical body was supported upon a short wrinkled stalk. The usual drawings represent this creature with a short bell-shaped body upon a very long slender pedicle. Possibly this one might have been able to show himself under this guise, but he did not attempt it; his appearance being always pretty much as described, which made the foot shorter and the body longer than the measurements which naturalists have given, and according to which the whole creature is 1-36″ long, although the body is only 1-140″. The tube of the *Œcistes* is called a "lorica," or carapace; but it has in truth no right whatever to the appellation.

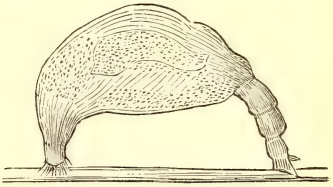
Another strange rotifer, of whose name I am uncertain, had an ovalish oblong body, and a pair of legs like compasses, twice as long as himself. His antics were those of a posture-master, or "Professor of Deportment" on stilts. Sometimes he stood bolt upright, bringing his legs close together; then they were jauntily crossed, and the body carried horizontally; then the two legs would be slightly opened, and the body thrown exactly at right angles to them. These antics were repeated all the while the observation lasted, and had a very funny effect in proving that drollery is practiced, if not understood, in the rotatorial world.

Another kind of rotifer was abundant—the *Philodina*, which belongs to the same family as the common wheel-bearer, namely, the *Philodinœa*. The *Philodina* is a good deal like the common wheel-bearer, or *Rotifer vulgaris*, but is usually of a stouter build, and carries his eyes in



Philodina (swimming).

a different place. In the common rotifer these organs are situated on the proboscis, while those of the Philodina are lower, and said to be "cervical." The changes of form in this rotifer are still more remarkable than in the common wheel-bearer. When resting it resembles a pear-shaped purse, puckered in at the mouth. Then it thrusts out its tail-foot, swells its body to an oval globe, protrudes its feeler, and slightly exposes a row of cilia. After this two distinct wheels are everted, and as their cilia whirl and spin, the animal is swiftly rowed along, until it thinks proper to moor itself fast by the tail-foot, and employ all its ciliary power in causing currents to converge towards its throat. When it pleases it can elongate the body, till it becomes vermiform, and it walks like the common rotifer, by curving its back, and bringing its nose and its tail in contact with the ground.



Philodina (crawling).

The gizzard of this family (*Philodinœa*) presents a considerable deviation from the perfect form exhibited by the *Brachions*. According to Mr. Gosse, "The *mallei* and the *incus* (terms already explained) are soldered together into two subquadrantic-globular masses, which appear to be muscular, but invested with a solid integument. The *manubria* (handles) may still be recognized in a vertical aspect as three loops, of which the central one is chiefly developed, and in a vertical aspect as a translucent reniform (kidney-shaped) globe." These descriptions are not easy to understand, not from any want of clearness or precision in the words employed, but from the complicated character of the organ, and its very different appearance under different aspects. To make the matter more intelligible, Mr. Gosse adds, "the structure and action of an apparatus of this type may be made more clear by a homely illustration. Suppose an apple to be divided longitudinally, leaving the stalk attached to one half. Let this now be split again longitudinally so far as the stalk, but not actually separating either portion from it. Draw the two portions slightly apart, and lay them down on their rounded surfaces. They now represent the quadrantic masses in repose, the stalk being the fulcrum, and the upper surfaces being crossed by the teeth. By the contraction of the muscles, of which they are composed, the two segments are made to turn upon their long axis, until the points of the teeth are brought into contact, and the toothed surfaces rise and approach each other. The lower edges do not, however, separate as the upper edges approach, but the form of the mass alters, becoming more lenticular, so that when the toothed surfaces are brought into their closest approximation, the outline has a subcircular figure. It is on account of this change of form that I presume the masses themselves to be partially composed of muscle."

These remarks, although specially made of the *Rotifer macrurus*, are in the main applicable to all the Philodinas, but the student must not expect to understand any of the complicated gizzards of the rotifers without repeated observations, and no small exercise of patience. It is common to call the portions of the Philodine-pattern gizzard "stirrup-shaped," but Mr. Gosse has shown them to be *quadrantic*, that is, shaped like the quarter of a sphere.

As we are not very well off with subjects for description at present, we can afford a little time to consider a question that continually arises in the mind on viewing the movements of animalcules, and especially of any so highly developed as the rotifers, namely, to what extent motions which appear intelligent are really the result of anything like a conscious purpose or will. When any of the lower animals—a bee, for example—acts in precisely the same way as all bees have acted since their proceedings have been observed, we settle the question by the use of the term *instinct*. Those who take the lowest view of insect life, assume that the bee flies because it has wings, but without wishing to use them, and that the nerves exciting them to action are in their turn excited, not by volition, but by some physical stimulus.

The sight or the smell of flowers is thought by the same reasoners to be capable of attracting the insect, which is unconscious of the attraction, while proximity of food stimulates the tongue to make the movements needful for its acquisition, and so forth. The cells, they tell us, are built according to a pattern which the earliest bee was impelled to construct by forces that bear no analogy to human reason and human will, and so originate all the ordinary processes of bee life. Sometimes, however, it happens that man or accident interposes particular obstacles, and forthwith there appears a particular modification of the orthodox plan, calculated to meet the special difficulty. How is this? Does any one of the difficulties which the bee or the ant is able to get over, produce precisely that kind of electrical disturbance, or polar arrangement of nerve particles that is necessary to stimulate the *first* step of the action by which the difficulty is surmounted; and does the new condition thus established stimulate the *second* step, and so forth, or can the bee, within certain limits, really *think*, design, and contrive?

No questions are more difficult of solution; but while protesting against a tendency to undervalue all life below that of man, we must remember we have in our bodies processes going on which are not the result of volition, as when the blood circulates, and its particles arrange themselves in the pattern required to form our tissues and organs, and also that many of our actions belong to the class termed by physiologists, "reflex," that is, the result of external impressions upon the nervous system, in which the *sentient* brain takes no part. Thus when a strong light stimulates the optic nerve, the portion of brain with which it is connected in its turn stimulates the iris to contract the pupil; and it is supposed that after a man has begun to walk, through the exercise of his will, he may continue to walk, by a reflex action; as his feet press the ground they transmit an impression to the spinal cord, and the legs receive a fresh impulse to locomotion, although the mind is completely oc-

cupied with other business, and pays no attention to their proceedings.* The ordinary movements of insects appear to be of this character, and to be excited by the ganglia belonging to the segment to which the moving limbs are attached. Thus a centipede will run, after its head has been cut off, and a water-beetle (*Dytiscus*) swam energetically when thrown into water after its brain has been removed.†

It must not, however, be assumed that the brain of insects has nothing to do with their movements. It is probably the means of co-ordinating or directing them to a common end, and gives rise to what are called *consensual* movements, that is, movements which are accompanied or stimulated by a sensation, although not controlled by a will. In man these actions are frequently exhibited, "as when laughter is provoked by some ludicrous sight or sound, or by the remembrance of such at an unseasonable hour."‡ Sneezing is another instance of a sensation leading to certain motions, without any intervention of the human will.

Speaking of these consensual motions, Dr. Carpenter observes, "It is probable, from the strong manifestations of emotion, exhibited by many of the lower animals, that some of the actions which we assemble under the general designation of instinctive are to be referred to this group."

The insect brain is composed of a supra-œsophagal ganglion and infra-œsophagal one. Von Siebold says, the first corresponds to the cerebrum of the vertebrata, and "the second is comparable, perhaps, to the cerebellum or spinal cord."§ The superior ganglion gives off nerves to the antennæ and eyes, the lower one to the mandibles, etc. So far as is known the insects that exhibit the most intelligence have the largest and best developed brains.

A special volume would be required for anything like a complete examination of the little which is known on this subject, but these few remarks may assist the microscopic beginner in examining the movements of his subjects, and guard against the error of referring to reason and volition those which are probably, either the direct result of stimulants applied to the surface (as in nerveless creatures), or the indirect (reflex) result of such stimulants in beings like the rotifers, who have a nervous system; or the result of *sensations*, which excite actions without previously referring the matter to the decision of a will. It must not, however, be too readily assumed that the behavior of creatures possessing distinct organs is entirely automatic; and we must not forget that even the best physiologists know very little concerning the range of functions which the nervous ganglia of the invertebrata are able to discharge.

*See Carpenter's "Manual of Physiology."
†Carpenter's "Manual of Physiology," p. 551.
‡Ibidi, p. 543.
§"Anatomy of Invertebrates," Burnett's trans.

Astronomy for Amateurs.

BY BERLIN H. WRIGHT.

(All calculations are for the Latitude and Meridian of New York City.)

THE PLANETS FOR MAY, 1882.

MERCURY may be seen during the last few days of May and the first of June as an evening star setting as follows:

May 26,	9h.	12m.,	evening.
" 30,	9	14	"
June 3,	9	13	"

He may be seen about 5° north of the sunset point. Venus and Mercury approach very closely on the 29th and 30th. Venus being distinguishable by her superior apparent diameter, milder light and by being south of Mercury; separated, however, by less than 2°. This will be an interesting occurrence to witness, which none should fail to see.

VENUS is rapidly receding from the Sun and moving eastward past the fixed stars. At the beginning of the month she is in the eastern part of Aries and between the Pleiades and Hyades, and on the 5th she passes Jupiter, being when nearest, about one degree north of him. Then passing over several degrees she enters the milky way. About the 20th and on the 29th she passes Mercury and proceeds eastward into Gemini. She will be about 15° S.W. of Castor and Pollux on the 30th.

She sets as follows:

May 10,	8h.	39m.,	even.
" 20,	9	1	"
" 30,	9	19	"

MARS is about 20° east of Venus and in the Constellation Cancer. He is in the group Prœsepe on the 18th, and 6° north of the Moon on the 22d. He sets as follows:

May 10th,	0h.	26m.,	morning.
" 20	11	59	evening.
" 30	11	36	"

JUPITER is too near the Sun to be successfully observed, being in conjunction with the Sun on the 30th.

SATURN, too, is invisible, being in conjunction with the Sun on the 6th, as is also Neptune.

TOTAL ECLIPSE OF THE SUN.

The Sun will be totally eclipsed on the 17th. This eclipse is visible throughout all of the

Eastern Continent, except the southern point of Africa. The line of totality passes through Shanghai and Nanking in China, Bagdad and Alcaba, and terminating near the west coast of Africa in 11° north lat. It is stated that Prof. Swift, of Rochester, N. Y., will be in Arabia to make search for the intra mercurial planets which he believes he has seen. Certainly if he does not meet with success in the pure dry atmosphere of Northern Arabia, further effort in that direction would seem useless.

APPEARANCE OF THE HEAVENS AT 9 P.M., MAY 20, 1882.

Looking southward the beautiful star Spica Virginis is very near the meridian and only 3° south or below the earth's path (Sun's apparent path). To the left of this star is the quadrilateral in Libra. Arcturus is about an hour east of the meridian and the large cluster of small stars called Berenice's Hair is almost overhead. The Sickle and Regulus in Leo are nearly half way to the western horizon, and still west of them is Mars in Cancer. Procyon is near setting. Castor and Pollux are higher up and further north, and Venus is west of them a few degrees.

In the east, Altair in the Eagle has just risen in the N.E., and Scorpio and Antares in the S.E.

Looking northward, the Great Dipper in Ursa Major is just north of our zenith; the head of Draco is to the right of Polaris, and Cassipeia's Chair below and close to the northern horizon. Algenib in the bright cluster in Perseus is just west of the lower meridian and near the horizon.

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS, MAY 21, 1882.

	H.	M.	
Alpha Andromedæ (Alpheratz) rises	0	8	morn
Omicron Ceti (Mira) variable, rises	4	26	"
Beta Persei (Algol) variable, rises	1	52	"
Eta Tauri (Alcyone or Light of Pleiades) rises	4	12	"
Alpha Tauri (Aldebaran) invisible			
Alpha Aurigae (Capella) sets	11	14	even
Beta Orionis (Rigel) invisible			
Alpha Orionis (Betelguese) sets	8	12	"
Alpha Canis Majoris (Sirius or Dog Star) invisible			
Alpha Canis Minoris (Procyon) sets	9	49	"
Alpha Leonis (Regulus) sets	0	47	morn
Alpha Virginis (Spica) in merid.	9	16	even
Alpha Bootis (Arcturus) " "	10	7	"
Alpha Scorpionis (Antares) " "	0	23	morn
Alpha Lyrae (Vega) " "	2	33	"
Alpha Aquillae (Altair) rises	9	13	even
Alpha Cygni (Deneb) in merid.	4	37	morn
Alpha Pisces Australis (Formalhaut) rises	2	52	"

THE MOON, THIRD QUADRANT, CONCLUDED.

Very near the southern limb of the Moon lies the deepest of the Lunar Craters—Newton (256). This is exceedingly irregular in outline, being about 142 miles long and 70 broad. Several lofty towers surmount the wall, the highest of which is 24,000 feet above the interior. There is only one small crater between this and the Moon's lower limb, where a series of colossal mountains stand out in bold relief, and are bathed in perpetual sunlight. The Moon's axis is inclined only about 1½° to her orbit, hence such mountains as are on or near the Arctic or Antarctic circle, as we apply those terms to the earth, are never in darkness. On each side of the South Pole and extending into both the 3d and 4th quadrants lie lofty peaks that project beyond the limb and break its continuity. Several of these measure nearly 30,000 feet, and one author announces 36,000 feet as the height of one. When the Moon is reduced to a delicate crescent near the new, these mountains prolong the horn. Just to the left and above Newton is an attractive crater (260) 51 miles in diameter and bearing a peak 18,000 feet above the interior. Almost touching the last is another, larger and steeper, and from its flat interior ten craterlets lift their heads.

In a direct line with the last two named craters and separated from 260 by its own diameter only, is another (265) very deep crater with a towering peak 20,000 feet high. Almost touching 265 upon the west is an interesting ring 78 miles broad and of very unequal height. It is 15,000 feet high on the west side and terraced within. This crater contains the highest central peak yet measured—6,800 feet. When the Sun rises or sets upon its peak it may be seen as a golden spot in the dark shadow of the surrounding wall. Look for it about one day after first quarter.

The numbering now carries us over to the East limb, where the naked eye detects a long black spot; this (272) crater has a darker interior than any other of its size. It is 147 miles long and 129 wide. A trifle east and extending far south of this great black crater is a series of ranges 20,000 or more feet high. Some of these may be seen projecting from the eastern limb. About 15° south of these seems to be a continuation of the same range projecting from the Moon's limb also—these are called the Rook Mountains.

WELLS' COMET, 1882.

Mr. S. C. Wells, Assistant at Dudley Observatory, at Albany, N. Y., discovered a comet of much prominence March 18.

From *The Science Observer*, of Boston, a periodical devoted to original astronomical work, we glean the following information: During the latter part of May the comet will be seen low in the N.W., with the bright star Capella 15° to the left.

Director Boss says of the comet: "It is evident that the comet should have a brilliant career; its light at perihelion (June 1) should be more than three thousand times greater than at discovery. I believe that the comet has a large and active nucleus, and if this be true, we ought to see a tail of immense proportions in June." This comet was unusually bright at discovery, considering its distance from the Sun, and its elements are very different from known comets.

Penn Yan, Yates Co., N. Y.

Silvering Iron.

A manufacturer in Vienna employs the following process for silvering iron: He first covers the iron with mercury, and silvers by the galvanic process. By heating to 300° C., the mercury evaporates and the silver layer is fixed. Ironware is first heated with diluted hydrochloric acid, and then dipped in a solution of nitrate of mercury, being at the same time in communication with the zinc pole of an electric battery, a piece of gas carbon or platinum being used as an anode for the other pole. The metal is soon covered with a layer of quicksilver, is then taken out and well washed and silvered in a silver solution. To save silver the ware can be first covered with a layer of tin; one part of cream of tartar is dissolved in eight parts of boiling water, and one or more tin anodes are joined with the carbon pole of a Bunsen element. The zinc pole communicates with a well cleaned piece of copper, and the battery is made to act till enough tin has deposited on the copper, when this is taken out and the ironware put in its place. The ware thus covered with tin chemically pure and silvered is much cheaper than any other silvered metals.

Writing with Lemon-juice.

Father John Gerard, of the Society of Jesus, who was confined and cruelly tortured in the Tower of London at the end of Queen Elizabeth's reign, was in the habit of writing letters in orange or lemon juice to his friends. The manner in which he thus baffled the vigilance of his jailers is described in detail in his highly interesting autobiography, published a few years ago by the Rev. Father John Morris. Father Gerard says:

"Now lemon-juice has this property, that what is written in it can be read in water quite as well as by fire, and when the paper is dried the writing disappears again till it is steeped afresh, or again held to the fire. But anything written with orange-juice is at once washed out by water and cannot be read at all in that way; and if held to the fire, though the characters are thus made to appear, they will not disappear; so that a letter of this sort, once read, can never be delivered to any one as if it had not been read. The party will see at once that it has been read, and will certainly refuse and disown it if it should contain anything dangerous."

One result of Father Gerard's orange-juice correspondence was that, with the aid of zealous friends outside, he effected his escape from the Tower in 1597. The last ten years of his life were spent in the English College at Rome, where he closed a long, arduous, and meritorious career on July 27, 1630, aged seventy-three.—*The Budget.*

To Clean Paint.

When paint is washed with any strong alkaline solution, such as soda or strong soap, the oil of the paint is liable to be changed to soap and the paint is seriously injured. To avoid this take some of the best whiting, and have ready some clean warm water and a piece of flannel, which dip into the water and squeeze nearly dry; then take up as much whiting as will adhere to it, apply it to the painted surface, when a little rubbing will quickly remove any dirt or grease stains. After this wash the part well with clean water, rubbing it dry with a soft chamois. Paint thus cleaned will look as well as when first put on, and the operation may be tried without fear of injury to the most delicate colors. It answers far better than the use of soap, and does not require more than one-half the time and labor. Another simple method is the following: Put a tablespoonful of aqua-ammonia in a quart of moderately hot water, dip in a flannel cloth and with this merely wipe over the surface of the woodwork. No rubbing is necessary. The first recipe is preferable, except where the paint is badly discolored.

A Scientific Joke.

A German newspaper some time ago related an amusing story of the famous scientist, Alexander von Humboldt, who took advantage of the exemption from duty of the covering of

articles free from duty, formerly the rule in France. In the year 1805 he and Gay-Lussac were in Paris, engaged in their experiments on the compression of air. The two scientists found themselves in need of a large number of glass tubes, and since this article was exceedingly dear in France at the time, and the duty on imported glass tubes was something alarming, Humboldt sent an order to Germany for the needed articles, giving directions that the manufacturer should seal the tubes at both ends, and put a label upon each with the words "*Deutsche Luft*" (German air). The air of Germany was an article upon which there was no duty, and the tubes were passed by the custom officers without any demand, arriving free of duty in the hands of the two experimenters.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business matter in letters or cards they are filed away and never reach the printer.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, wher we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

Blow-pipe set (cost $10), large illustrated family Bible (cost $7.50), for Wood's Botany, Dana's Geology, or printing press and type. H. W. Noble, Box 134, South Dansville, N. Y.

Wanted, offers for fossil shells from the west coast of Africa. A. W. Seward, 187 E. 71st St.

I have a number of birds' eggs I should like to trade for other birds' eggs; send for list of trading eggs. A. G. G., Box 26, Summit, New Jersey.

For a microscope stand or offers, a 36-inch turning lathe (new) and a number of scientific books; send for list. A. Kendall, Somerville, Mass.

Wanted services of amateur printer with small office (or large), in exchange for an interest in a well-established weekly paper, good size. Eagle Office, Plymouth, N. H.

American Agriculturist microscope, new, cost $15, for amateur photographic apparatus, lever watch, 22 calibre breech-loading sporting rifle or magic lantern of equal value. Wm. A. Walker, Rockland, R. I.

I. T. Bell, Franklin, Pa., has back numbers of Scientific American, Forest and Stream, and Young Scientist, good flute, chessmen, books, etc., for good magic lantern, revolver, scarce coins, or offers.

A steel spring bracket-saw, 2 doz. saw blades, and about 1 doz. patterns for a good stylographic pen or offers; send postal before exchanging. Geo. Oakley, Rutherford, N. J.

A rosewood banjo, 11 inch head, 12 nuts, fully strung, together with lot of dime banjo music and instructions, for microscope, Webster's Unabridged, monkey, squirrel and cage, or offers. J. DeWitt Clark, P. O. Box 37, Brooklyn, N. Y.

For self-inking printing press and type, one Henry rifle, 16 shot, 44 cal., cost $40, in good order, or one double barrel shot gun, barrels London fine twist, or offers. J. B. Garrison, Belton, Bell Co., Texas.

A new 40 diameter microscope, corals, and minerals, for a stylographic pen, air gun, or offers. J. McBride, 54 Garley St., Chicago.

What offers for "The Chefs D'Oeuvre D'Art, Paris Exhibition 1878," cost $16, good as new, bound; 1 large photo camera, complete, cost $95; Scientific American from 1859 to 1880, 4[illegible] vols. bound. D. Keesler, Stony Point, N. Y.

Sea shells of Atlantic coast, scientifically marked, for books, old or new magazines, Indian relics, natural history specimens, apparatus; anything. Wilfred Leon Miller, P. O. Box 392, Cape May, N. J.

A dulcimer that cost $20, books and fossils, for a telescope, microscope, fossils, Indian relics, or offers. E. J. Votaw, Salem, Iowa.

A self-inking model press, 5 x 7½, cost $23; $90 worth of scroll-saw designs in lots to suit; Scientific American, 1880; Palliser's Useful Details, $3; for photo outfit or offers. C. H. Parker, Coldbrook Springs, Mass.

Telegraph key and sounder, Frank Leslie's Illustrated Magazines, mounted microscopic objects, natural curiosities, for bull's-eye condenser, photograph camera, Unabridged Webster Dictionary, or offers. W. T. Alan, Greenville, Mercer Co., Pa.

Large magic lantern, spectroscope, pantagraph, for enlarging drawings, rosewood writing desk, man's saddle, for microscope, photo outfit or offers. Thomas Walters, Bergen St., East of Brooklyn Ave., Brooklyn, N. Y.

Model card press, chase 3¼ x 5¼, with 4 fonts type, cases, etc., for good foot lathe. Mills Day, 2 Farmington Av., Hartford, Ct.

French microscope, inclines to any angle, delicate fine motion, neat upright case, cost $17.50, for scientific books; send list to W. Fitz, P.O. Box 2852, New York.

Wanted, Quinby's New Bee Keeping, for Our Own Birds of the United States, by W. S. Baily; new. Joseph Anthony, Jr., Coleta, Whiteside Co., Illinois.

Printing type, small pica; large and small capitals, and small letters; 60 to 65 lbs., including two large cases; also gothic nonpariel, for trade. J. Siler, 1242 Broadway, St. Louis, Mo.

One years' copy of Aldine, cost $5.50, and German accordion, with instructions how to use it, cost $5.00, for offers. Chas. Dempwolf, 86 Benson St., Paterson, N. J.

A Novelty printing press, with type, prints a form 5 x 7 inches, cost $40.00, for a microscope, photographic apparatus, or offers. T. W. Patterson, Warsaw, N. Y.

$80 worth of (nearly new) printing material, minerals, fossils, Aboriginal relics, etc., for scientific books, good American watch, and offers. F. M. Farrell, Cobden, Union Co., Ills.

Rocks, minerals, fossils and fresh water shells for microscope stand, $20 to $75, also for objectives, turning lathe type, and tools. D. D. Babcock, South Dansville, N. Y.

Mechanical Electricity, Medical Chemistry, by Robert Hare; Fruits and Farinacea, by Trall; Complete Herbalist, by O. P. Brown; for mounted objects for the microscope or offers. J. B. Playter, Bristow, Butler Co., Iowa.

Violin (cost $10) and 5-shot 32-cal. revolver (cost $4), for photo-camera lens and tube, watch, parlor rifle, extra well-bred canary birds, or offers. C. Maides, St. Louis, Mo.

To exchange for a wood-turning lathe or offers, a Young America Self-inking Printing Press, with type and outfit complete; chase 3 x 5 inches. Embury McLean, 318 Bloomfield St., Hoboken, N. J.

What offers for "Our First Century," cost $7.00, bound in sheep, over 400 illustrations, 1,000 pages; also small Ruby Magic Lantern, cost $1.50. Box 217, So. Manchester, Conn.

Magic lantern, in good order, condensing lens, 2½ in. diameter, 8 slides. For small photographic camera or offers. H. A. Giddings, 4 Union Place, Classon Ave., Brooklyn.

Printing press, type, etc., worth $13, for offers. E. G. Vogeley, 1010 Bradford St., Pittsburgh, Pa.

Fifty canary birds, with and without crests; fancy poultry, conch shells, strombus alatus. For small printing press, books on natural history, or offers. Frank Lattin, Gaines, N. Y.

A good plain 7 shot revolver, 22 calibre, for a Students' inch or half-inch objective. Frank F. Colwell, Urbana, Ohio.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

Vol. V. NEW YORK, JUNE, 1882. No. 6.

Caution to Bee-Poisoners.

FROM notices in several of our exchanges we learn that some thoughtless and ignorant persons, urged by so-called scientific men who certainly ought to know better, are attempting to destroy by poison such bees as annoy them. Aside from the fact that such a practice is contrary to law, to good morals, and to right feeling, those who think of adopting this vile practice should remember that it is not at all impossible that they may take the life of something much more important than a few bees. Some human being may fall a victim and then the poisoner may find himself in the clutches not only of a guilty conscience, but of the law. Nor is it necessary that man, woman or child should find access to the vessels set out for the destruction of the bees; unless under extraordinary conditions the bees will carry to their hives, before they die, an amount of poisoned food sufficient to render the honey in their combs virulently poisonous.

This is not a mere surmise or theory, but a fact which some years ago we demonstrated clearly and fully to our own satisfaction. The records of the experiments were unfortunately destroyed in the great fire which consumed the "World Building" last January, but the results were so clear and unequivocal that we can give them from memory without any material inaccuracy.

In these experiments we established small colonies of bees in locations where they could not interfere with other stocks, and selecting times at which food was scarce, we fed them upon syrup to which poison had been added. In every case we succeeded in destroying the bees, but it was only in a very few cases that we failed to get poison from the honey in the hive, and in these cases the bees took the poison only when no other source of food supply was open to them. In many cases the bees that carried the poison to the hive did not seem to suffer till long after the

young bees were all dead; in some cases the queen was amongst the very first to fall a victim, and next came the young bees, just emerged from the cells.

We used about a dozen different varieties of poison in our experiments, and we fed it to the bees at distances from their hives varying from three feet to a mile and a half. The latter, of course, was easily done by means well known to every bee-hunter.

When arsenic or paris green was used we found no difficulty in detecting arsenic, by means of the usual chemical tests, in the honey taken from the hive. A little of the honey added to the liquid in a Marsh's apparatus readily gave the beautiful characteristic arsenical mirror, and some of the honey fed to mice killed them very quickly.

Nor is this to be wondered at. The honey-sac of the bee is not a true stomach but rather a muscular bag, which exerts very little action on its contents. This is readily seen in the case of the delicate odors of flowers which are retained by the honey in the comb after it has passed through the honey-sac of the bee. Hence, we have clover honey, bass-wood honey, buckwheat honey, etc.—all readily recognizable after they have been deposited in the hive. As might be supposed, therefore, when the bee has but a short distance to go, it invariably succeeds in depositing several loads of the poisoned honey in the hive before it succumbs. When the distance is very great the case is different, and many bees will then die on the way or just after reaching their hives. But in ordinary cases it is only those bees whose hives are quite near that prove an annoyance, and they are the ones that are least affected.

To attempt to poison bees, therefore, is to attempt to mix poison with a common and much-valued article of human food, and the consequences may be of the most serious nature. We feel assured that all that is necessary in order to put a stop to the practice, is the diffusion of accurate knowledge on the subject.

Transporting Aquatic Animals.

BY A. W. ROBERTS.

MANY years ago, before I had had any experience in public aquariums, my method of transporting both marine and fresh-water animals was to change the water at certain well known points along the route of collection, or if marine animals, to always return home on some steamboat over the sides of which, and by means of one of the deck buckets and the kindly assistance of a deck hand, I always obtained a plentiful supply of cool, clean and well oxygenated salt water. This course was particularly necessary during the hot summer months. One day I missed my boat connection, but a good natured Long Island farmer gave me a lift to Brooklyn in his wagon; of course I expected to find all the fish dead. Great was my surprise to find them alive and looking splendid. This fact bothered me

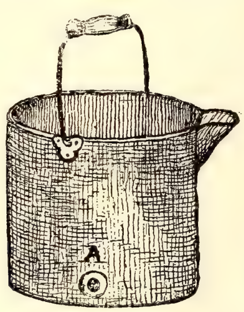


Fig. 1.—Outer Can.

Fig. 2.—Inner Can.

SMALL DOUBLE CAN FOR THE TRANSPORTATION OF FISH.

greatly, and set me to thinking and reasoning out the cause of so strange a phenomenon. I had read in some book that the result of the constant agitation of the ocean by means of tides, winds, and waves was to keep the water in a perfectly fresh condition suitable for the healthy existence of the animal and vegetable life. I then remembered my anxiety regarding the safety of my fish during their journey on account of the constant slashing of the water in the can, as the wagon passed over the rough cobble stone pavements of the streets; and yet the life of my fish had been preserved by this very alarming jolting and consequent agitation of the water. From this experience was suggested the idea of raising the water in the collecting can by means of a hand dipper, and allowing it (the water) to fall from a height of some two feet back into the can, and by this means nose to the surface, clearly detect the change; and so I came to learn that salt water, no matter how foul it may become, can always be restored to a healthy condition for sustaining animal life by resting it in a dark room, then agitating it as above described, and carefully pouring it back into the aquarium after it has rested for a day or so. And thus you see how knowledge was gained by the accidental missing of the steamboat and my ride over the rough streets of B———. For a small collecting can I know nothing better than the one shown in Figs. 1 and 2. Fig. 1 is an ordinary milking can well coated both inside and outside with asphalt varnish; a hole is cut into the side which is strengthened on the inside and outside with a heavy tin collar, as shown at A, into this hole a cork is inserted. Fig. 2 is a can one-half inch smaller in circumference than that shown in Fig. 1, into

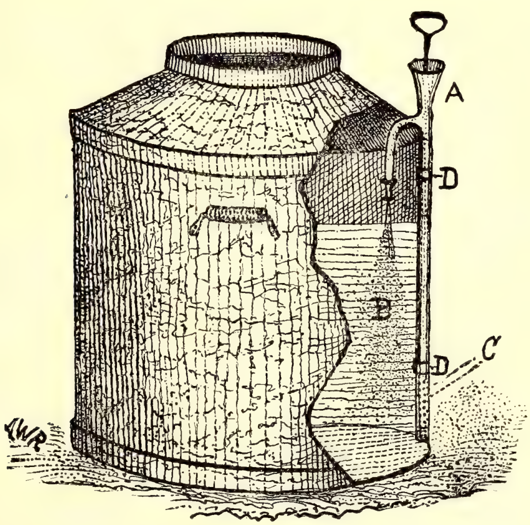


Fig. 3.—ZINC CAN AND PUMP.

driving vast quantities of minute globules of air into the water and thereby oxygenating it thoroughly. I had often saved the salt water contained in my tanks, which had become charged with carbonic acid, by pouring the water back and forth into a pail till it foamed, thereby releasing the poisonous gas and charging the water with oxygen till I could, by placing my which it is intended to fit. On the sides of the can B, eight corks one-quarter of an inch in thickness, are fastened, as shown at C C C, C C C, and also three on the bottom of the can C C C. The sides of the inner can B is perforated with small holes as shown in Fig. 2; at the bottom the perforations cease where the corks are attached as shown in the cut. This inner can is pro-

vided with a short bailer; a close fitting top with very fine perforations will be found to be of great advantage. This double can is operated in the following manner.

The perforated can is placed within the larger can, Fig. 1, both cans are then filled with water, and the animals are placed within the perforated can. When reaching a location where the water can be changed, the inner can is quickly lifted out and the water is allowed to empty out through the perforations till it reaches the space at the bottom of the can that is not perforated; here the animals will remain surrounded with sufficient water; the larger or outer can is then filled with new water, and when this has been accomplished the inner can is placed in position, and is immediately filled. In this way all handling and consequent injury to the fish is avoided. The corks attached to the sides and bottom of the inner can are for the purpose of keeping it in its position and also to prevent it from pressing and jarring against the outer can.

Fig. 3, is a can consisting of heavy sheet zinc strengthened at the bottom and at the elbow and top with galvanized iron bands or hoops. A is a movable hand force pump, which is introduced into the can through two holes situated at the elbow of the can; the body of the pump is passed along the side of the can through two loops or rings of zinc D D. The end of the pump is perforated at the suction end as shown at C. By means of the metal hand pump the dead and exhausted water at the bottom of the can is constantly lifted and dashed against the surface water, thereby thoroughly oxygenating the water in the can, at the same time constant circulation of the water is obtained, which is very necessary when transporting the young of salmon, trout, or black bass. In this can an immense quantity of the lower marine and fresh water animals can be transported successfully.

—Iron or steel immersed in a solution of carbonate of potash or soda for a few minutes will not rust for years.

The Nautilus and Ammonite.

[We have frequently had inquiries for the following poem by the lamented geologist, Richardson. It was printed by Dr. Mantell at the close of a small book written by him and entitled "Thoughts on a Pebble," but has been but rarely reprinted, though it deserves that honor.—Ed. Y. S.]

The Nautilus and the Ammonite
Were launched in storm and strife;
Each sent to float in its tiny boat
On the wide wild sea of life.

And each could swim on the ocean's brim,
And anon its sails could furl;
And sink to sleep in the great sea-deep,
In a palace all of pearl.

And theirs was bliss more fair than this
That we feel in a colder clime:
For they were rife in a tropic life
In a brighter, happier time.

They swam mid isles whose summer smiles
No wintry winds annoy;
Whose groves were palm, whose air was balm,
Whose life was only joy.

They sailed all day through creek and bay,
And traversed the ocean deep;
And at night they sank on a coral bank,
In its fairy bowers to sleep.

And the monsters vast of ages past
They beheld in their ocean caves;
They saw them ride in their power and pride,
And sink in their deep sea graves.

Thus hand in hand, from strand to strand,
They sailed in mirth and glee;
Those fairy shells, with their crystal cells,
Twin creatures of the sea.

But they came at last to a sea long past;
And, as they reached its shore,
Th' Almighty's breath spake out in death,
And the Ammonite lived no more.

So the Nautilus now, in its shelly prow,
As o'er the deep it strays,
Still seems to seek, in bay and creek,
Its companion of other days.

And thus do we, on life's stormy sea,
As we roam from shore to shore,
While tempest-tossed, seek the loved, the lost,
But find them on earth no more.

Yet the hope how sweet, again to meet,
As we look to a distant strand,
Where heart meets heart, and no more we part,
Who meet in that better land.

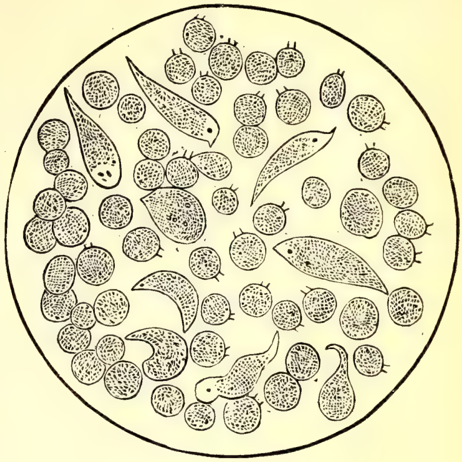
Marvels of Pond Life.—X.

IN the beginning of August a pond in the Finchley Road, a little beyond the Highgate Archway, supplied some more specimens of the *Pterodina patina*, described in a previous article ; but towards the middle of the month a visit to Chipstead, in Surrey, enabled a new region to be explored.

It is always a treat to a Londoner to get down to any of the picturesque parts of Surrey; the trees exhibit a richness of foliage and variety of color not seen within the regions of metropolitan smoke; the distance glows with the rich purples so much admired in the pictures of Linnel, and the sunsets light up earth and sky with the golden tints he is so well able to reproduce. Probably the warmth of the soil, and the purity of the air, may make Surrey ponds prolific in microscopic life; but of this we do not know enough to make a fair comparison. although our own dips into them were tolerably lucky.

Walking one day down a lane leading towards Reigate, where the trees arched overhead, ferns grew plentifully in the sandy banks, and the sunlight flitted through the branches, and chequered the path, we came to a shallow pond, or great puddle, which crossed the way, and near the edge of the water the eye was struck with patches of crimson color. On attempting to take up a portion of one of these patches the whole disappeared, although when the disturbance ceased the rich color again clothed the dingy mud. The appearance was caused by thousands of little worms, belonging to the genus *Tubifex*, not uncommon in such situations, who thrust themselves out to enjoy the light and air, and retreat the moment an alarm is given. Probably both actions belong to the class described in the last article, as "reflex;" but it would be interesting to know whether creatures so humble have any sense of fear. These worms will repay observation, but in these pages we eschew all their tribe—unless the rotifers be assigned to them—and take ourselves once more to our especial subjects.

Knowing that farm-ponds are usually well stocked with microscopic game, we made a dip into one more especially assigned to ducks, and obtained wondrous little for our pains. We were not, however, discouraged, but made an examination of the circumstances, which determined a particular course of action. Our piece of water was simply a dirty duck-pond, in which no large plants were growing, and which did not even exhibit the little disks of duckweed that are common to such situations. There was, however, on the surface, in parts, an exceedingly fine scum of pale yellow green, and this, armed with a teaspoon, we proceeded to attack. By careful skimming, a small bottle was half-filled with minute organic particles, which were likely to be interesting in themselves, and pretty sure to be the food for something else. A small drop was placed on a tablet of the live-box, flattened out by the application of the cover, and viewed with a power of two hundred linear, which disclosed swarms of brilliant green globes, amongst which were a good sprinkle of minute creatures, like the *Euglenæ* already described, and whose little red eyes contrasted vividly with the prevaling emerald hue.



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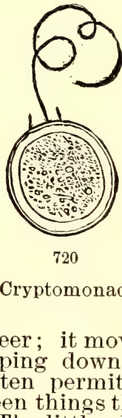
Cryptomonad—Euglena.

One of the higher infusoria, whose species I could not identify, was devouring them like a porpoise among sprats. It did not, however, exhibit any sense in its hungry career; it moved about in all directions, gulping down what came in its way, but often permitting the escape of the little green things that were almost in its mouth. The little globes rolled and whirled about without the fair test indica-



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Cryptomonad.

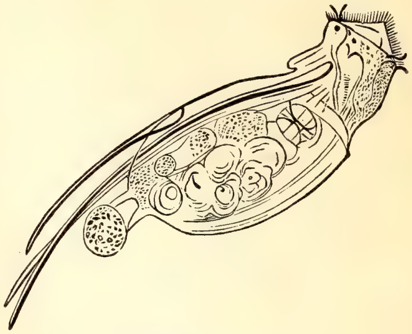
tion of a purpose, and without exhibiting any instrument with which their locomotion was effected. To find out how this was done, a higher power was used, and from their extreme minuteness an amplification of seven hundred and twenty linear was conveniently employed, although a lower one (three or four hundred) disclosed the secret by showing that a little whip was flourished about through the neck, which the lower power revealed. When highly magnified, each little globe was seen to consist of an outer case of a reddish orange color, which was noticeable on looking at the edges, although in the centre it was transparent enough to show the brilliant green contents, that resembled the chlorophyl, or green coloring matter of plants. From a short neck proceeded the whip-like filament, which was lashed and twisted about in all directions. These little creatures belong to the monad family, but whether they are to be called *Trachelomonads*, or by some other hard name, the learned must decide.

The 'Micrographic Dictionary' puts a note of interrogation to the assertion of some writers that *Trachelomonads* have no necks, and draws some with such an appendage.

Pritchard's last edition is against necks, and whether the necks or no necks are to win, is a mighty question, equal at least to the famous controversy, which divided the world into "big and little endians in the matter of breaking eggs."

A discussion of more importance is, whether these *Cryptomonads*—that name will do whatever comes of the neck controversy—are animals or vegetables. Lachmann and Mr. Carter affirm that they have detected a contractile vesicle, which would assimilate them to the animal series, but their general behavior is vegetable; and the 'Micrographic Dictionary' is in favor of referring them to the *Algæ*—that great family of simple plants, of which the sea-weeds are the most important representatives.

When any of the monads swarm, there are sure to be plenty of other creatures to eat them up, and in this instance the predaceous animalcule, already described, was not the only enemy the little green globes had to suffer from, as two sorts of rotifer were frequently met with. One of these was a very handsome and singular creature, which in some positions had the general contour of a cockatoo, only that the legs were wanting, and the head exhibited a monkey face. The "wheels" were represented by ciliary tufts, and two bright red eyes twinkled with a knowing look. From each shoulder proceeded a long curved spine, and about two-thirds down the body, and lying between the two long spines, a shorter one was articulated, which followed the same curve. A gizzard was busy in the breast, and the body terminated in two short toes which grasped a large round egg. Whenever the cilia were drawn in, the three spines were thrown up; but they had an independent motion



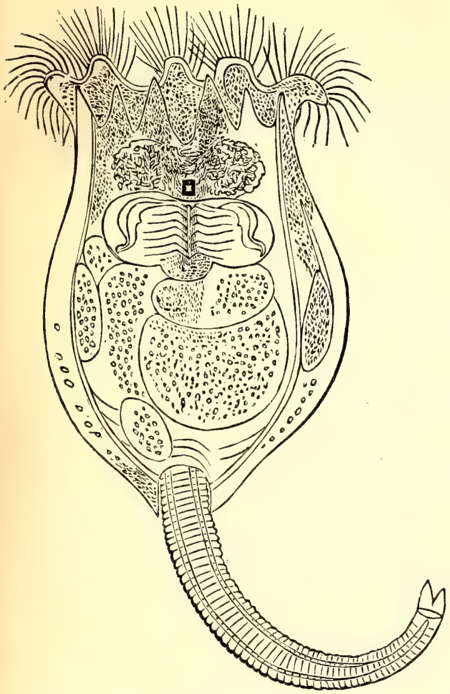
Triarthra. × 130.

of their own, and every now and then were jerked suddenly and violently back, which occasioned a rapid change in the creature's position. The gizzard appeared to consist of two rounded masses, having several ridges of teeth, which worked against each other something like the prominences of a coffee-mill. From the three spines, this animal was a *Triarthra*, or Three-limbed Rotifer, but the position of the spines, and the toes, made it differ from any species described in the 'Micrographic Dictionary,' or in Pritchard.

Whether or not this species is to be regarded as having a lorica or not, must depend upon the precise meaning attached to that word. At any rate the integument was much firmer than in many of the rotifers, and gave an efficient support to the spines which a mere skin could not do. As Mr. Gosse remarks of an allied genus, the *Polyarthra*, or Many-limbed Rotifer, this creature could not be investigated without coming to the conclusion "Here again we have true jointed limbs;" a fact of great importance in determining the zoological rank of the family, and in supporting Mr. Gosse's view some at least bore a strong affinity with the group of *Arthropoda*, of which the insects are the principal representatives.

Another rotifer of even greater interest, which was busy among the Cryptomonads, was the Brachion, or "Pitcher Rotifer" (Brachionus). The members of this genus will frequently reward the scearcher into pond-life. Their main characteristic is a cup or pitcher-shaped lorica, which is cut or notched at the top into several horns or projections, the

number of which indicates the species; while two or more similar projections ornament the bottom. This lorica is like the shell of a tortoise open at both ends; from the top an extremely beautiful



Brachionus Urceolaris. × 240.

This drawing has been accidentally reversed by the engraver, which alters the relative place of the internal organs.

wreath of cilia is protruded and also some longer and stiff cilia, or slender spines, which do not exhibit the rotatory movement. The ciliary apparatus is in reality continuous, but it more often presents the appearance of several divisions, and the lateral cilia frequently hang over the sides. From the large size of each cilium they are very favorable creatures for exhibing the real nature of the action, which gives rise to the rotatory appearance, and which can be easier studied than described. By movements, partly from their base, and partly arising from the flexibility of their structure, the cilia come alternately in and out of view, and when set in a circular pattern, the effect is amazingly like the spinning round of a wheel. The internal arrangements of the Brachiones are finely displayed, and they have a most aldermanic allowence of gizzard, which extends more than half way across each side of the median line, and shows all the portions described by Mr. Gosse. As the joints of this machine move, and the teeth are brought together, one could fancy a sound of millwork was heard, and the observer is fully impressed with a sense of mechanical power.

When the creature is obliging enough to present a full front view, her domestic economy is excellently displayed. The prey that is caught in her whirpool is carried down by a strong ciliary current to the gizzard, which may be often seen grappling with objects that appear much too big for its grasp; and Mr. Gosse was lucky in witnessing an attempt to chew up a morsel that did actually prove too large and too tough, and which, after many ineffectual efforts, was suddenly cast out. As soon as food has passed the gizzard, it is assisted in its journey by more ciliary currents, which are noticeable in the capacious stomach, in the neighborhood of which the secreting and other vessels are readily observed. Just over the gizzard blazes a great red eye, of a square or oblong form, and it reposes upon a large mass of soft granular-looking brain, which well justifies Mr. Gosse's epithet "enormous." Whether this brain is highly organized enough to be a *thinking* apparatus, we do not know, but it is evidently the cause of a very vigorous and consentaneous action of the various organs the Brachion possesses.

A description of the Brachion would be very incomplete if it omitted that important organ the tail, which in this family reaches the highest point of development. It is a powerful muscular organ, of great size in proportion to the animal, capaple of complete retraction within the carapace, and of being everted wholly, or partially, at will. It terminates in two short conical toes, protruded from a tube-like sheath, and capable of adhering firmly even to a substance so slippery as glass. This tail may be observed to indicate a variety of emotions, if we can ascribe such feeling to a rotifer, and it answers many purposes. Now we see it cautiously thrust forth, and turned this way and that, exploring like an elephant's trunk and almost as flexible. Now it seizes firm hold of some substance, and anchors its proprietor hard and fast. A few moments afterwards it lashes out right and left with fury, like the tail of a cat in a passion. Then again it will be retracted, and a casual observer might not imagine the Brachion to be furnished with such a terminal implement.

The Brachiones may often be seen with one or more large eggs stuck about the upper part of the tail, and others may be discerned inside. One specimen before

us has three eggs attached to her in this way. They are large oval bodies, with a firm shell. These creatures differ very much in appearance, according to the direction in which they are seen, and a side view makes them look so different from a full front or back aspect, that it would be easy to suppose another animal was under observation. The extent to which the ciliary apparatus is protruded, and the pattern it forms likewise differs continually; and hence no drawing, however correct, is sure to resemble the arrangement that may be presented to the observer's eye. But however our little "Pitcher" may be viewed, it is sure to prove a spectacle of interest and delight.

Burnishing.

BY burnishing, the roughness of an object is flattened down until the surface is smooth and polished like a looking-glass. Burnishing is an important operation for electro-deposits, which consist of a multitude of small crystals, with intervals between them, and with facets reflecting the light in every direction. The deposited metal is hardened and forced into the pores of the underlying metal, and the durability is thus increased to such an extent that, with the same amount of silver, a burnished article will last twice as long as one which has not been so treated. The instruments employed for burnishing are made of different materials, and must be of great hardness and a perfect polish—such as hardened cast steel, agate, flint, and bloodstone. For metallic electro-deposits steel and bloodstone are especially employed. There are several qualities of bloodstone; its grain should be close, hard, and without seams or veins; it should leave no white lines on the burnished parts, nor take off any metal, and its color should be of an intense black red. The steel must be fine and close grained, and perfectly polished. Should the polish of any burnishing tool alter by use, it is restored by friction upon a skin or leather attached to a wooden block, which is fixed to the bench. The leather is covered with polishing rouge in impalpable powder, or, preferably, with pure alumina, obtained by calcining ammonia alum in a forge fire. Venetian tripoli, rottenstone, tin putty, emery, or many other hard substances finely powdered, may be employed. The burnishing tools are of various shapes, such as a lance, a tooth, a knife, a half sphere, or a dog's tongue, and a considerable stock is necessary. The burnishing is divided into two distinct operations. The first consists in roughing, and the second in finishing. The tools for the first have a sharp edge, while for the second operation they have a rounded surface. The tools for the hand or the lathe are fixed by copper ferrules into short round wooden handles, so that the hand is not influenced by their weight. The tools for the arm or vise are fastened to wooden handles sufficiently long to rest their slender part upon the arm or shoulder. The stouter lower portion is grasped by the hand. The burnishing tools and the objects must be frequently wetted by certain solutions, some of which facilitate the sliding of the instrument, or with others which have a chemical action upon the shade of the burnished articles. Of the first are pure water, solutions of soap, decoctions of linseed, and infusions of the roots of marsh mallow or licorice. The second includes wine-lees, cream of tartar, vinegar, alum in water. When burnishing gold applied upon electro-deposits of copper, as in gilding with a dead lustre by that method, use pure water, for fear of producing a disagreeable red shade. A solution of green soap is sometimes preferred by operators, although when old it imparts an unpleasant tinge, owing to the sulphides of the liquor. When the burnishing is completed, the surface is wiped longitudinally with a soft and old calico rag. The polish obtained by burnishing is called black when it reflects the rays like a mirror; and should the presence of mercury or a bad deposit prevent the tool from producing a bright surface, the object is said to be greasy. Articles which have been previously polished, and which generally receive a very trifling deposit, are not burnished, but rubbed with chamois leather and the best polishing rouge. Too thick or too rapid electro-deposits cannot be burnished, but must be polished by rubbing with a leather and a mixture of oil and powdered pumice-stone, tripoli or tin putty. Coarse powders are used at the beginning, and impalpable ones at the end of the operation. Polished silver deposits are more agreeable to the eye than burnished ones, but the hardening of the latter renders them more durable. —*Metal Worker.*

Cleansing Soiled Chamois.

SOILED chamois is often thrown aside and wasted for the want of knowing how to clean it. Make a solution of weak soda and warm water, rub plenty of soap into the leather and allow it to remain in soak for two hours, then rub it well until it is quite clean. Afterward rinse it well in a weak solution composed of warm water, soda, and yellow soap. It must not be rinsed in water only, for then it would be so hard, when dry, as to be unfit for use. It is the small quantity of

soap left in the leather that allows the finer particles of the leather to separate and become soft like silk. After rinsing, wring it well in a rough towel and dry quickly, then pull it about and brush it well, and it will become softer and better than most new leathers. In using a rough leather to touch up highly polished surfaces, it is freqently observed to scratch the work; this is caused by particles of dust, and even hard rouge, that are left in the leather, and if removed by a clean rougey brush it will then give the brightest and best finish, which all good workmen like to see on their work.

Ebonizing Wood.

ALL the world now knows of those articles of furniture of a beautiful dead-black color, with sharp, clear-cut edges, and a smooth surface, the wood of which seems to have the density of ebony. Viewing them side by side with furniture rendered black by paint and varnish, the difference is so sensible that the considerable margin of price separating the two kinds explains itself without need of any commentary. The operations are much longer and much more minute in this mode of charcoal polishing, which respects every detail of the carving, while paint and varnish would clog up the holes and widen the ridges. In the first process they employ only carefully selected woods, of a close and compact grain; they cover them with a coat of logwood dissolved in water, and almost immediately afterwards with another coat, composed chiefly of sulphate and acetate of iron. The two compositions, in blending, penetrate the wood, and give it an indelible tinge, and, at the same time, render it impervious to the attacks of insects.

When these two coats are sufficiently dry, they rub the surface of the wood at first with a very hard brush of couch-grass (*chiendent*), and then with charcoal of substances as light and friable as possible, because if a single hard grain remained in the charcoal, this alone would scratch the surface, which they wish, on the contrary, to render perfectly smooth. The flat parts are rubbed with natural stick charcoal, the indented portions and crevices with charcoal powder. At once, almost simultaneously, and alternately with the charcoal, the workmen also rubs his piece of furniture with flannel soaked in linseed oil and the essence of turpentine. These pouncings, repeated several times, cause the charcoal powder and the oil to penetrate into the wood, giving the article of furniture a beautiful color and perfect polish, which has none of the flaws of ordinary varnish. Black wood, polished with charcoal, is coming day by day to be in greater demand; it is most serviceable; it does not tarnish like gilding, nor grow yellow like white wood, and in furnishing a drawing-room, it agrees very happily with gilt bronzes and rich stuffs. In the dining-room, too, it is thoroughly in its place to show off the plate to the greatest advantage, and in the library it supplies a capital framework for handsomely bound books.—*Cabinet Maker*.

Mosaics.

THE extraordinary delicacy and accuracy acquired by workers in Mosaic, both as regards shape and color, form a marked illustration of the power of physical education. In a portrait of Pope Pius V. there were, 1,700,000 pieces each no larger than a grain of millet. The enamel is a kind of glass colored with metallic oxides, which is fused and drawn out into threads, small rods, or oblong sticks of varying degrees of fineness, slightly resembling the type used by compositors. These many colored rods are kept in drawers properly numbered, so that the artist always knows to which case to repair when he requires a fresh supply of a particular tint or tints. When the picture is commenced the first step is to place on the easel a slab of marble, copper, or slate, of the sized fixed upon; and this slab is hollowed out to a depth of about three and a half inches, leaving a flat border all round which will be on a level with the completed mosaic. The excavated slab is intersected by transverse grooves or channels so as to hold more tenaciously the cement in which the mounts of enamel will be embedded. Then the hollowed slab is filled with "gesso," or plaster-of-Paris, on which the proposed design is accurately traced in outline, and usually in pen and ink.

The artist then proceeds to scoop out a small portion of the plaster with a little sharp tool. He fills up the cavity thus made with wet cement or "mastic," and into this mastic he successively thrusts the "spiculæ," or the "tesseræ," as the case may be, according to the pattern at his side. In the broad folds of drapery or in the even shadows of a background, or a clear sky, his morsels of enamel may be as large as one of a pair of dice; in the details of lips, or eyes, or hair, or foliage, or flowers, the bits of glass may be no larger than pins' heads. The cement, or mastic, is made in various ways, the best being formed of slaked lime, finely powdered Tiburtine marble, and linseed oil, and when thoroughly dry is as hard as flint. Sometimes the mastic which fills the cavity is smoothed and painted in fresco with an exact replica of the pat-

tern, and into this bits of glass are driven, according to tint, by means of a small wooden mallet. If the effect produced wounds the artist's eye, he can easily amend the defect by withdrawing the offending piece of enamel and driving in another while the cement is still wet; and, by observing proper precautions, it can be kept damp for more than a fortnight. When the work is completed any tiny crevices which may remain are carefully plugged or "stopped" with pounded marble, or with enamel mixed with wax, and the entire surface of the picture is then ground down to a perfect plane, and finally polished with putty and oil. Byzantine may be broadly distinguished from Roman mosaic by the circumstance of the surface of the former being left unground or unpolished—save where there is burnished gold—thus leaving an irregularity of surface productive of great vigor of effect. A picture of the Byzantine style can at once be recognized as a mosaic, even if it be hung at an altitude of one hundred feet from the ground; but a perfected mosaic picture, after the Roman manner, might easily be mistaken, even at a very short distance, for a very elaborately finished and highly varnished painting in oils.

How to Make an Electric Battery.

Amateur experimenters in electricity will find the following battery an exceedingly cheap, yet strong one. Anyone with care and thought can make it.

The materials used are as follows: One common fruit jar, one piece of zinc, twelve inches by three wide, a small flower-pot (unglazed) about three inches deep, piece of gas-carbon, two ounces of bichromate of potash, two ounces of sulphuric acid and three ounces of common salt.

We will begin with the jar. Dip in kerosene about one yard of twine and wind it around the jar about three inches from the bottom. Ignite it and slowly revolve the jar in the hands so as to have the flame on all sides of the jar at once. When the jar cracks, strike the open end with a piece of wood and the jar will crack off where the string was placed. Remove the sharp edges with a file and the battery jar is finished.

Solder a piece of copper wire to one corner of the zinc and then roll it into a cylinder form about the size of the jar. The wire from this zinc constitutes the negative pole of the battery. With a little melted tar stop the hole in the bottom of the flower-pot.

At the gas factory obtain a piece of gas-carbon the size of your wrist and three or four inches long. Drill a small hole in one end and twist a stout piece of copper wire into it. Apply a little melted tar around the wire where it enters the carbon, which will partly protect it from the attacks of acid. This wire from the carbon constitutes the positive pole from which the electricity flows.

To prepare the acid, place a pint of warm water in a bottle, and add the bichromate; when nearly dissolved add the sulphuric acid. In preparing this acid be very careful as it is very poisonous and corrosive.

In the bottom of the jar place the salt. Then place in the zinc. Inside of the zinc place the pot. Into the pot place the carbon with the wire projecting upwards. Fill this pot with the acid. Fill the jar within one-quarter of an inch of the top of the pot with water. In a few moments the battery will be ready to work. Connect the wires and the circuit is complete from the carbon to the zinc. When in a dark room a bright electric spark may be seen at the moment the wires are disconnected. Therefore, electric phenomena is only obtained when there is a metallic circuit between the positive and negative poles.

To maintain the battery, recharge the pot with acid about once in two or three weeks, according to the use. Renew the salt water about once in a month. A number of experiments may be performed with this battery, one of which I will describe in the next number.

GEORGE THOMPSON.
Malden, Mass.

Luminous Paint.

The comparatively recent discovery that luminous paint can be applied as ordinary whitewash, considerably expands the field of its usefulness. Sheets of glass coated with the paint form Aladin's lamps, which are in use in some of the vessels of the navy, at the Waltham Powder Factory, at Young's Paraffine Works, and in the spirit vaults of several docks; but now that, by increased production and the use of water as the medium, the cost is reduced by one-half, it will probably be extensively used for painting walls and ceilings. The ordinary form of oil paint has already been applied in many ways to clock-faces, to name-plates and numbers and house doors, and to notice boards, such as "mind the step," "to let," etc. The paint emits light without combustion, and, therefore, does not vitiate the atmosphere. Several experimental carriages are now running on different railways, the paint being used instead of lamps, which are necessary all day on account of the line passing through occasional tunnels. It is reported that a paper at Turin called *Light* is to appear shortly, printed in ink

which will be luminous when darkness sets in. Who can say, indeed, that a policeman, when smeared in this luminous composition, will not be sometimes visible on his beat at night?

The following method of procedure will, it is said, give a very satisfactory luminous paint: Take a number of oyster shells, cleaned from organic matter as thoroughly as possible, and burn them in a strong coal fire for about half an hour, at the end of which time take them out and allow to cool. When quite cold, pound them fine, removing, during this operation, any particles of gray matter that may show themselves, as these are useless. When finely powdered, make an intimate mixture of this with flowers of sulphur. Introduce the mixture into a crucible, luting on a lid to the vessel with clay, or other convenient luting material. When this is dried, place the crucible in the fire and allow it to remain for an hour; then remove, and allow to cool before opening. The mixture then should appear pure white. Any gray particles that have escaped removal at the first preparation, should be removed now. The resulting powder should be mixed with gum water to a thin paint, as two thin applications are better than one thick one. This paint will remain luminous far into the night, provided it is exposed to the light during the day.—*Building News.*

Polishing Glass.

Besides the oxide of zinc (commonly called ashes of zinc), is usually used for the cutting and polishing of glass. In glasses intended for optical purposes, the very finest polish can, of course, be only obtained by exceedingly fine grained oxide of iron. But since such an article can not always be obtained, and even oxide of iron prepared after Vogel's receipt from oxidulated protoxide of iron does not always answer the purpose, the glasses polished with it sometimes looking dim and brown yellow, because the finest particles of the preparation enter the pores of the glass, Professor Dr. J. I. Pohl made experiments with oxide of zinc. The result answered, as *Dingler's Polytechnical Journal* states, perfectly the expectations entertained. The sorts used were: 1. The finest white zinc, such as the factory of Peteswald, in Silesia, puts into the market. Of these the grey zinc was found particularly well adapted to cut glass, while the Hamburg white answered for common polishing. The finest white zinc was found to be excellent for the so-called "high polish" of optical glasses. White zinc does not only polish quickly, but with the finest sort the very highest white brilliancy can be obtained. For polishing the very expensive optical glasses, Prof. Pohl considers the white zinc known in France under the name of *blanche de niege* (*i. e.*, snow white) best adapted.

Practical Hints.

To Clean Bronze Statues.—The objectionable dark coating which most bronze statues soon acquire, with the look of cast iron, may be very quickly and completely washed off by means of a concentrated solution of carbonate of ammonia, applied with brushes. Thereupon a layer of patina is formed, which guards the statue against fresh formation of the dark coat. The work should, of course, only be entrusted to skilled and intelligent men. Another method is to paint the statue, at intervals of a few weeks, repeating with a solution of 20 parts anhydrous vinegar in 100 parts bone oil. The acetate and oleate of copper salts thus produced, form first a thin green layer, which hinders the attachment of dirt and dust, and occasions further patina formation.—*English Mechanic.*

A Screw-Driver Improvement.—Most people who use screw-drivers must be occasionally inclined to use strong language at their persistency in slipping out of the nick, and their refusal to go into it. All that is wanted is a short tube, big enough to enclose the screw-head somewhat tightly, but only spring-tight, so that it may rise as the screw-head comes near the wood. Also, to provide for heads of different sizes with the same driver. All this can be done by just turning up a strongish tin tube, three or four inches long, like a slate pencil case, big enough to slide over the widened point of a round screw-driver, and then fitting spring-tight on the shank by means of a piece ef leather wrapped round it; and for larger screws than usual, you might pull the socket off and put a larger on, with a thicker piece of leather. I find it answers perfectly. You need not even look at your screw, but just put the tubed screw-driver on, and turn. It will drop into the nick at the first half-turn, and stay there till the screw is screwed home.—*English Mechanic.*

Pocket Knives.—The thwytel or whittel of Chaucer's period was a very poor, rude instrument, consisting of a blade of bar steel fastened into a wooden or horn handle. It was used for cutting food, as well as for the numerous miscellaneous duties which now fall to the pocket knife. To the whittel succeeded the Jack-Knife—the Jacques-de-Liege, or Jock-te-leg of the Scottish James VI—which formed the prototype of the modern clasp knife, inasmuch as the blade closed into a groove in the handle. This improved form was probably introduced into Sheffield by Prostestant refugees from the Low countries, who came to England during the reign of Queen Elizabeth, Shortly thereafter, about the beginning of the 17th century, the pocket knife with spring back was introduced, and no marked improvement took place till the early part of the present century.

Mechanical Equivalent of Heat.—It does not appear to be generally known that the value of the mechanical equivalent of heat has within a few years been corrected. It is generally referred to by mechanical writers at 772 foot pounds. Dr. Joule repeated his famous experiments in 1876, nearly six years ago, with extraordinary precautions, and the mean result of sixty experiments gave 774.1 foot pounds with a possible error of 1.400, on account of the "thermometric scale error." This value should be used in all calculations relating to the value of heat as a motive power.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business matter in letters or cards they are filed away and never reach the printer.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

Blow-pipe set (cost $10), large illustrated family Bible (cost $7.50), for Wood's Botany, Dana's Geology, or printing press and type. H. W. Noble, Box 134, South Dansville, N. Y.

Wanted, offers for fossil shells from the west coast of Africa. A. W. Seward, 187 E. 71st St.

I have a number of birds' eggs I should like to trade for other birds' eggs; send for list of trading eggs. A. G. G., Box 26, Summit, New Jersey.

For a microscope stand or offers, a 36-inch turning lathe (new) and a number of scientific books; send for list. A. Kendall, Somerville, Mass.

Wanted services of amateur printer with small office (or large), in exchange for an interest in a well-established weekly paper, good size. Eagle Office, Plymouth, N. H.

American Agriculturist microscope, new, cost $15, for amateur photographic apparatus, lever watch, 22 calibre breech-loading sporting rifle or magic lantern of equal value. Wm. A. Walker, Rockland, R. I.

I. T. Bell, Franklin, Pa., has back numbers of Scientific American, Forest and Stream, and Young Scientist, good flute, chessmen, books, etc., for good magic lantern, revolver, scarce coins, or offers.

A steel spring bracket-saw, 2 doz. saw blades, and about 1 doz. patterns for a good stylographic pen or offers; send postal before exchanging. Geo. Oakley, Rutherford, N. J.

A rosewood banjo, 11 inch head, 12 nuts, fully strung, together with lot of dime banjo music and instructions, for microscope, Webster's Unabridged, monkey, squirrel and cage, or offers. J. DeWitt Clark, P. O. Box 37, Brooklyn, N. Y.

For self-inking printing press and type, one Henry rifle, 16 shot, 44 cal., cost $40, in good order, or one double barrel shot gun, barrels London fine twist, or offers. J. B. Garrison, Belton, Bell Co., Texas.

A new 40 diameter microscope, corals, and minerals, for a stylographic pen, air gun, or offers. J. McBride, 54 Garley St., Chicago.

What offers for "The Chefs D'Oeuvre D'Art, Paris Exhibition 1878," cost $16, good as new, bound; 1 large photo camera, complete, cost $95; Scientific American from 1859 to 1880, 4 vols. bound. D. Keesler, Stony Point, N. Y.

Sea shells of Atlantic coast, scientifically marked, for books, old or new magazines, Indian relics, natural history specimens, apparatus; anything Wilfred Leon Miller, P. O. Box 392, Cape May, N. J.

A dulcimer that cost $20, books and fossils, for a telescope, microscope, fossils, Indian relics, or offers. E. J. Votaw, Salem, Iowa.

A self-inking model press, 5 x 7½, cost $23; $90 worth of scroll-saw designs in lots to suit; Scientific American, 1880; Palliser's Useful Details, $3; for photo outfit or offers. C. H. Parker, Coldbrook Springs, Mass.

Telegraph key and sounder, Frank Leslie's Illustrated Magazines, mounted microscopic objects, natural curiosities, for bull's-eye condenser, photograph camera, Unabridged Webster Dictionary, or offers. W. T. Alan, Greenville, Mercer Co., Pa.

Large magic lantern, spectroscope, pantagraph, for enlarging drawings, rosewood writing desk, man's saddle, for microscope, photo outfit or offers. Thomas Walters, Bergen St., East of Brooklyn Ave., Brooklyn, N. Y.

Model card press, chase 3¼ x 5¼, with 4 fonts type, cases, etc., for good foot lathe. Mills Day, 2 Farmington Av., Hartford, Ct.

French microscope, inclines to any angle, delicate fine motion, neat upright case, cost $17.50, for scientific books; send list to W. Fitz, P.O. Box 2852, New York.

Wanted, Quinby's New Bee Keeping, for Our Own Birds of the United States, by W. S. Baily; new. Joseph Anthony, Jr., Coleta, Whiteside Co., Illinois.

Printing type, small pica; large and small capitals, and small letters; 60 to 65 lbs., including two large cases; also gothic nonpariel, for trade. J. Siler, 1242 Broadway, St. Louis, Mo.

One years' copy of Aldine, cost $5.50, and German accordion, with instructions how to use it, cost $5.00, for offers. Chas. Dempwolf, 86 Benson St., Paterson, N. J.

A Novelty printing press, with type, prints a form 5 x 7 inches, cost $40.00, for a microscope, photographic apparatus, or offers. T. W. Patterson, Warsaw, N. Y.

$80 worth of (nearly new) printing material, minerals, fossils, Aboriginal relics, etc., for scientific books, good American watch, and offers. F. M. Farrell, Cobden, Union Co., Ills.

Rocks, minerals, fossils and fresh water shells for microscope stand, $20 to $75, also for objectives, turning lathe type, and tools. D. D. Babcock, South Dansville, N. Y.

Mechanical Electricity, Medical Chemistry, by Robert Hare; Fruits and Farinacea, by Trall; Complete Herbalist, by O. P. Brown; for mounted objects for the microscope or offers. J. B. Playter, Bristow, Butler Co., Iowa.

Violin (cost $10) and 5-shot 32-cal. revolver (cost $4), for photo-camera lens and tube, watch, parlor rifle, extra well-bred canary birds, or offers. C. Maides, St. Louis, Mo.

To exchange for a wood-turning lathe or offers, a Young America Self-inking Printing Press, with type and outfit complete; chase 3 x 5 inches. Embury McLean, 318 Bloomfield St., Hoboken, N. J.

What offers for "Our First Century," cost $7.00, bound in sheep, over 400 illustrations, 1,000 pages; also small Ruby Magic Lantern, cost $1.50. Box 217, So. Manchester, Conn.

Magic lantern, in good order, condensing lens, 2½ in. diameter, 8 slides. For small photographic camera or offers. H. A. Giddings, 4 Union Place, Classon Ave., Brooklyn.

Printing press, type, etc., worth $13, for offers. E. G. Vogeley, 1010 Bradford St., Pittsburgh, Pa.

Fifty canary birds, with and without crests; fancy poultry, conch shells, strombus alatus. For small printing press, books on natural history, or offers. Frank Lattin, Gaines, N. Y.

A good plain 7 shot revolver, 22 calibre, for a Students' inch or half-inch objective. Frank F. Colwell, Urbana, Ohio.

Good Writing.—No one can write rapidly and legibly without a good pen, and unfortunately there are many pens in market that are not good. The majority of writers find that Esterbrook's Falcon steel pen suits their hand, and our experience is that no pen retains its good qualities longer.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

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Practical Hints on the Construction of the Violin—III.

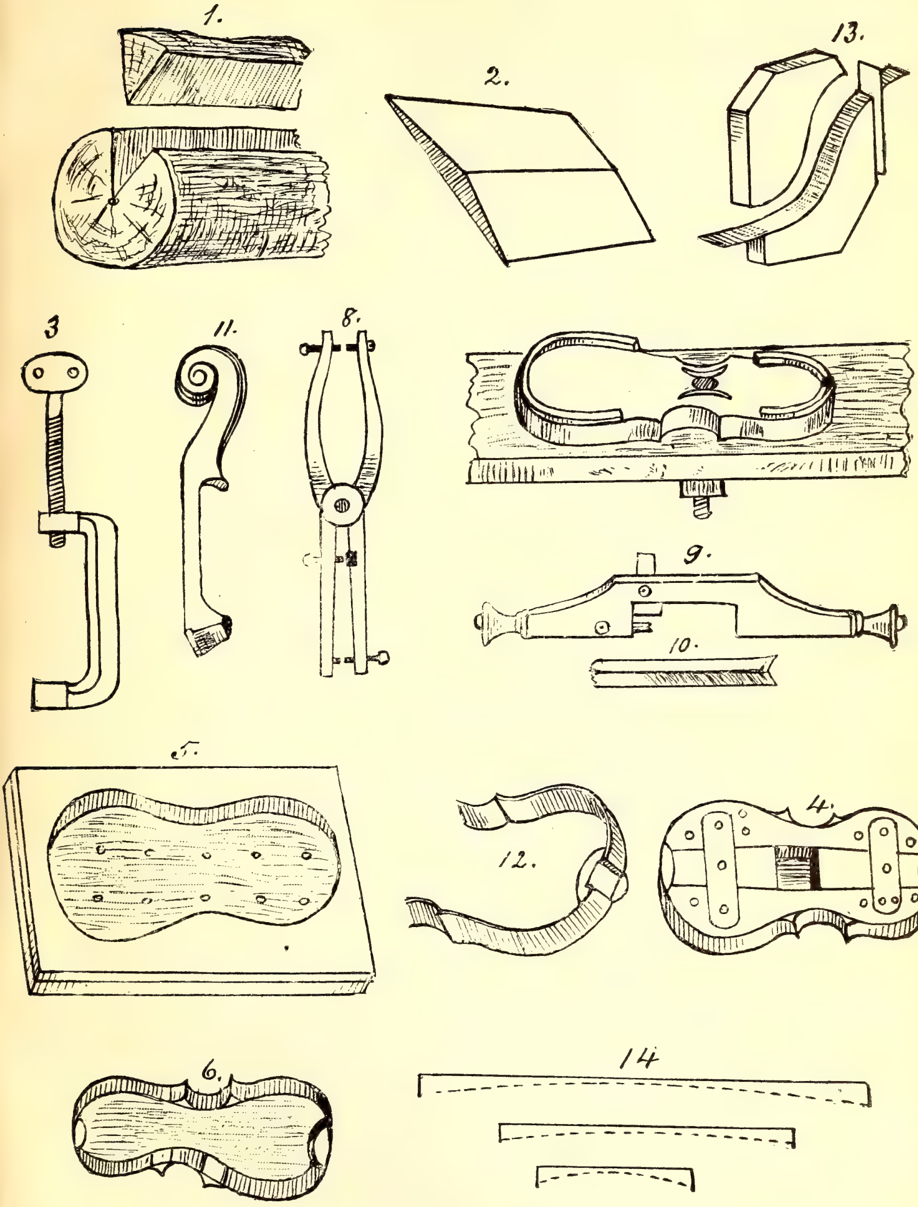
IN our last chapter we gave a brief sketch of the manner of preparing the mold and setting up the sides, but we omitted a very important item. The quality of the tone of a violin depends in a great measure on the quantity of air contained. The back and belly of the instrument may be most gracefully modeled, and of the proper thickness, but if the quantity of air contained within, be either deficient or in excess, the tone will always remain bad. The reason of this is evident. It is the air within the instrument which, when put in motion by the vibration of the back and belly, produces the sound. Now if the internal capacity of the instrument be too great, the air will be in excess, and consequently the tables are not able to give it the number of vibrations in a given time necessary to produce the right quality of sound. On the other hand, if the capacity of the body of the violin be too small, the tables will give the air contained too much vibration. In the first case, the tone will be hollow and dead, in the latter shrill and harsh. The air contained in a good violin should, when vibrated by blowing into one of the sound holes, give the note C on the G string of the instrument. As the amateur will find great difficulty in getting by calculation the right size, let him choose a good instrument and follow its proportions with accuracy. By comparing different instruments he will see a great difference in the form and manner of construction. Some have the tables very much elevated, while those of others are very flat, but he will also, on careful examination, find in all good violins, that when the tables have a high model the other dimensions are less than in those whose tables are less elevated. This is for the reason given above, namely, to regulate the inside

capacity so that the air contained may be, as near as possible, the same, no matter what the outward shape may be. With these preparatory remarks, we will now proceed to explain the manner in which the back and belly are fashioned.

We will suppose the parts have been properly glued together. A pattern of zinc or cardboard of the exact size and shape is laid on and the outlines marked with a sharp pencil. Then, with a good scroll saw, cut all the way around, following the pencil mark as closely as possible. The amateur must have a bench on which to work out his model. Let him take a block of good hard wood about two inches thick, of the same shape as his violin plate, but somewhat larger. Let him cut a few strips of white holly about an eighth of an inch thick, so that they may roughly fit around the edges of his plate, cutting small slots in them, and screwing them down to his bench with round-head screws, so as to clamp the plate firmly; the slots are for the purpose of sliding the clamps backwards or forwards when the screws are slackened so as to release the plate. Let him then hollow out his bench in the centre to make it correspond roughly to the swell of his instrument, and fasten it to a cabinet-maker's or carpenter's bench with a strong bolt having a nut beneath so that he may swivel his work-bench or make it fast at pleasure (see Figure 7). He is now ready to begin the modeling of the outside of his plate. Having chosen a good violin as a pattern, he takes a few strips of wood about an inch and a half wide by an eighth thick. These he lays edgewise on the back of his pattern violin, and with a scribing tool, marks on them the swell of the instrument. He then cuts out with a sharp knife, following the scribe. These will guide him in working the outside of his back (see Figure 14). The roughing off may be done with large gouges and chisels, but the finishing must be done with steel scrapers and sand-paper. In the final polishing the sand-paper should be very fine, and the plate should be wet from time to time so as to raise all the loose fibres of the wood, that they may be cut off cleanly, leaving a smooth glossy surface. When the surface of the plate has been properly finished, the next operation is to trim and round the edges neatly with a file and sand-paper. The plate is now ready for the purfling or fillets. This part of the work requires great care. The fillets are thin strips of wood glued together—usually a centre-piece of ebony and two outside pieces of white holly. A recess is cut with a tool made especially for the purpose around the edge of the plate, the fillets are inserted, glue being previously laid in the recess, neatly mitered at the corners and tapped down firmly in their place.

Before proceeding further, we deem it advisable to furnish cuts of the principal appliances used by violin-makers. Figure 1 shows the manner in which the sections of wood are cut from the tree. Figure 2 will serve to give an idea of how the sections are glued together. Figure 3 is an iron screw-clamp which will be found very useful. Figure 4 is the mold on which the sides are set up. Figure 5 is the frame in which the mold is screwed fast in order that the sides may be wedged tight to the mold and glued to the blocks and corners. Figure 6 shows the sides in position and glued in their places. Figure 7 is the work-bench. Figure 8 callipers for gauging the thickness of the back and belly. Figure 9 shows the purfling tool, and 10 the cutter. The purfling tool should be made of brass, as in the engraving, with swiveling knobs at each end, and having a movable gauge at the back, and set-screw to regulate the distance of the groove from the edge of the plate. The cutter is a piece of round steel about one-sixteenth of an inch in diameter. One end is squared with a file, and into this end a recess is cut diagonally with a fine three-square file. The cutter is then placed in the instrument in a hole drilled to receive it and made fast with a set screw. Figure 11 is the neck, and 12 shows the recess in the end block for its reception. Figure 13 is a contrivance for bending the side-pieces, and 14 gives an idea of the guides used in modeling the tables of the violin.

In our next we shall have something to say about the working of the inside of the



DETAILS OF VIOLIN CONSTRUCTION.

plates, and on the proper degree of thickness which they ought to have in order to give the best results.

How to Make an Electric Bell.

FIRST, obtain at the blacksmiths' a piece of round iron about four and a half inches long and of a size that will fit the hole in a thread spool about an inch and a quarter long. Have the iron bent into a U shape as in Fig. 1, the arms of which should be about one inch and a quarter long and one inch and a half apart. Take the spools and whittle them down to a thin shell, so as to allow the wire which is to be wound around them to come as near the hole as possible. Divide your insulated wire into two equal lengths, each of which is to be wound around the spools separately. Before beginning to wind the spools drill a small hole the size of the wire through the wooden shell at one end, then insert one end of the wire, letting it project a few inches from the inside, then begin to wind the first layer, and wind neatly back and forth until all of that piece of wire is used. Wind the other spool in the same way, taking care to wind both spools in the same direction. After this is done place the spools on the arms of the U; scrape the insulating covering from the ends of the wires which were left projecting from the inside of the spools, and twist them together as in Fig. 2. This U-shaped iron with its spools of wire, will, when properly connected with the poles of the battery, form an electro-magnet, the iron being magnetic only when the coils of wire around it form the circuit of a battery.

To make the armature and bell-hammer: Take a strip of iron one inch and three-quarters long and about as thick as a ten cent piece and rivet to one end of this piece of iron a piece of clock-spring about one inch long. To the other end solder a stout piece of wire the size of a knitting-needle, four inches long, and fasten to the end of it a small knob, after which bend it into the shape shown in Fig. 3, which shows the armature and bell-hammer complete. To make the circuit-breaker: Take another piece of clock-spring an inch and a quarter long and punch a small hole in one end, into which rivet a short piece of copper wire which may afterwards be filed down to a small knob on the spring. Solder the other end of the spring under the head of a round-headed brass screw, as in Fig. 4. Next procure the bell. Any bell not exceeding six inches in diameter will answer.

To put the apparatus together and operate: Obtain a board about one inch thick, four inches wide and nine inches long. Screw the electro-magnet to the board as in Fig. 5 by a small cross-piece. Support the armature close to and opposite the ends of the electro-magnet by fastening the end of the spring to a small brass support shown at A. Screw the circuit-breaker, Fig. 4, into place at B, and bend it so that the little knob will just touch the stout wire where it is soldered to the armature. Screw the bell on at F, so that the knob will just strike the edge when the armature strikes the ends of the magnet. Paste a small strip of thin paper on the inside of the armature so it will not stick to the ends of the magnet, as the particles of steel in the iron do not lose their magnetism when the circuit is broken. *Remember that all contacts of wires and other parts through which the current is to flow must be scraped bright.* When all parts are in place, connect the wires as follows: one wire from the electro-magnet is to be led to and placed between two copper washers which are clamped together by a round-head screw, screwed into the board at D. Fasten the other wire from the magnet to the support which holds the armature at A. Then with a short bit of copper wire connect the screw which holds the circuit breaker with two more copper washers arranged to clamp the wire at E in the same way as at D. To ring the bell, clamp the wire from the positive pole of the battery, between the washers at D. Then with the wire from the other pole touch the washers at E, and if the apparatus has been properly made and adjusted the bell will ring while the connection is made. Now trace the course of the current. It

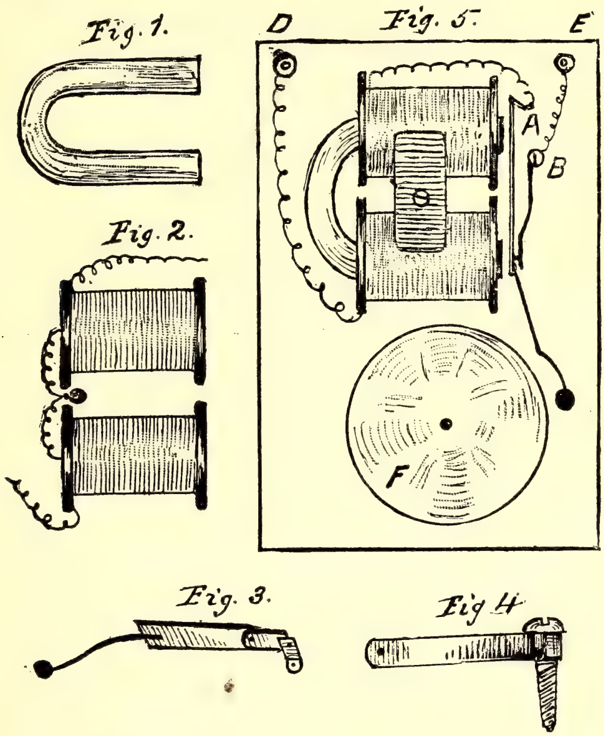
flows through the binding-screw D, then through the coils on the arms of the U, thence to A, and through the armature to circuit breaker B, and back to battery through the binding screw E. The completion of the circuit makes a magnet of the U and draws the armature to itself, and by doing so, breaks the circuit between the armature and spring B, which causes the magnet to lose its power, thus enabling the spring on the armature to return it to its normal position, which completes the circuit, and the operation is again repeated and so on, while the battery is connected. Your electric bell is now complete, and at some future time I hope to tell you of its practical uses.

GEO. THOMPSON.

Malden, Mass.

Marvels of Pond Life.—XI.

SCATTERED about Hampstead Heath are a number of little pools, not big enough to be dignified by the name of ponds. They are generally surrounded by furze bushes, and would escape attention if not actually looked for. Those which are mere puddles, and have only a brief existence in rainy weather, seldom reward the labor of investigation; but others are permanent, except after prolonged drought, and afford convenient situations for the growth of confervæ, star-weed, and other plants. These will nearly always repay the microscopic collector during the winter, when he must break the ice to get at their contents; in spring, when long chains of frog-spawn afford ocular evidence of the prolific properties of the Batrachian reptiles; and in summer, when they afford both shade and sunshine to their numerous inhabitants. Small beetles, water-spiders, larvæ of



ELECTRIC BELL.

gnats, and other insects, rotifers, including the tubicolar sorts, and several varieties of infusoria may be expected and generally found. There is, however, a curious fact about ponds, big and little, which Pritchard remarks upon in his 'Infusoria,' and which corresponds with our own experience, that those which have proved to be well stocked with any particular creature during one year, will very likely contain none of it in the next. There are of course exceptions to this rule, but we have often been astonished and disappointed at finding the complete change, both in populousness and population, that a revolution of twelve months will make; and it would be extremely interesting to notice the changes that took place during a term of years.

Such researches might unfold some unexpected laws in the succession of infusorial life. Those germs which are most widely diffused, will be the most likely to be developed in any mass of convenient water; but how and why the rarer forms come and go is very imperfectly understood. Slight modifications in surrounding circumstances will materially affect the result. Thus, if we bring home a handful of conferva, and a few water-plants of higher organization, such as duck-weed and anacharis, and place the whole in a glass jar full of pond water, we shall at first have a good stock of objects; but they will usually grow less and less, until scarcely anything is left. If, however, we introduce a few pieces of straw, or a tiny wisp of hay, we shall succeed much better, and not only preserve our population longer, but enjoy a succession of animated crops. Extensive decomposition of vegetable matter kills off all but certain families, such as Paramecia, who enjoy it; on the other hand, too little decomposition proves fatal to some creatures, by depriving them of their food, and when they have died off, those who depended upon them for a living, die too. Different vegetables in decomposition suit different creatures, and hay and straw in that state seem to please the largest number. An animalcule tank will succeed best when it contains two or three kinds of growing plants, which oxygenize the air, and a moderate variety of decomposing organisms will supply food without making the water offensive.

From these considerations it will be apparent that not only the nature of the vegetation of a pond, which is often changed by accidental circumstances, but also the quality of the odds and ends that the winds may blow into it, or which may fall through the air, will do much to determine the character and number of its inhabitants, while the quantity of shade or sunshine it enjoys, will also exercise an important influence. Hay and other infusions have from the beginning of microscopic investigations been employed to obtain the creatures which the Germans call "Infusions thierchen" (infusion animalcules), and the English "Infusoria;" but very little has yet been done in the way of their scientific culture and management.

To return from this digression to our little Hampstead ponds, we obtained from one, in September, that was full of star-weed, a number of sugar-loaf bodies, adhering to one another, and of a pale yellow brown color. The specimens first examined looked complete in themselves, and were taken for eggs of some water creature. Further search, however, disclosed aggregations of similar sugar-loaves that had evidently formed part of a tubular structure, and the idea at once occurred that they were fragments of a Melicerta tube, a conclusion that was verified by finding some tubes entire and a dead Melicerta in the rubbish at the bottom. All the specimens of Melicerta tubes we had hitherto examined were composed of *rounded* pellets, but these were made of pointed cones or sugar-loaves, with the points projecting outwards from the general surface. In Pritchard's 'Infusoria,' these pellets are described "as small lenticular bodies." The 'Micrographic Dictionary' states that the tubes of the Melicerta are composed of "numerous rounded or discoidal bodies;" and Mr. Gosse, in his 'Tenby,' which contains an admirable description, and an exquisite drawing of this interesting rotifer, calls the pellets "round."

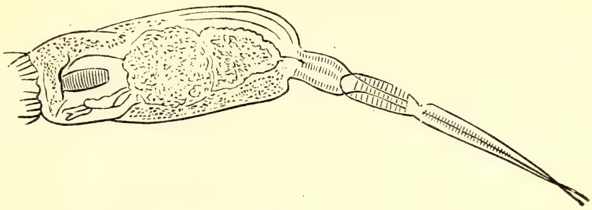
Not being able to obtain a living specimen of the Melicerta, who made her tube of long sugar-loaves, I could not tell whether she differed in structure from the usual pattern of her race, but the general appearance of the dead body was the same. It is possible that these creatures possess some power of modifying the form of their singular bricks, or they may at different ages vary the patterns, which matters some fortunate possessor of a colony of these animals may be able to verify.

In the sediment of the water containing the Melicerta cases was found an animalcule about 1-120'' long, covered with cilia, and having a proboscis seldom more than a quarter of the length assumed by the body, which continually changed its form, sometimes elongating, sometimes shortening, and often contracting one side into a deep fissure. It was, probably, an *Amphileptus*, though not precisely agreeing with any drawing or description I am acquainted with. Another inmate of the same water was a lively long-tailed rotifer, with a small oval body, a tuft of vibrating cilia and a curved bristle visible among them on one side. This creature had a

jointed tail-foot, ending in two long style-shaped toes, and by means of this appendage executed rapid leaps or springs. It was the *Scaridium longicaudum*, and agreed in dimensions tolerably well with the size given in the books, namely, total length 1-72″. With a power of five hundred diameters the muscles of the tail-foot presented a beautifully striated appearance.

susceptible of greater modification than is exhibited by the ordinary infusoria.

The Stephanoceros is a member of the Floscule family, but in all the specimens I obtained and watched for several weeks, there was an important difference in the relation of the tube to the creature. In the Floscules I had never seen anything like an adhesion between the tube and the animal, but in the Stephanoceros I noticed



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Scaridium longicaudum.

Towards the end of the month I passed the Vale of Heath Pond, Hampstead, and although I had not gone out for the purpose of collecting, was fortunately provided with a two-dram bottle. Close by the path the *Anacharis alsinastrum* grew in profusion, quantities of water-snails crawled among its branches, and small fish darted in and out, threading their mazes with lightning rapidity. Thrusting a walking-stick among the mass of vegetation, a few little tufts were drawn up and carefully bottled, with the addition of a little water. Returning home, a few leaves were placed in the live-box, and on examination with the power of sixty diameters they disclosed a specimen of, perhaps, the most beautiful of all the rotifers, the *Stephanoceros Eichornii*. In this elegant creature an oval body, somewhat expanded at the top, is supported upon a tapering stalk, and stands in a gelatinous bottle, composed of irregular rings superimposed one upon the other, as if thrown off by successive efforts, the upper ones being inverted and attached to the body of the animal. But that which constitutes the glory of this little being is the crown of five tapering tentacles, each having two rows of long cilia arranged on opposing sides, but not in the same plane. The ordinary position of the tentacles is that of a graceful elliptical curve, first swelling outwards, then bending inwards, until their points closely approximate, but each is capable of independent motion, and they are seldom quiet for many minutes at a time. The cilia can be arranged in parallel rows or in tufts at the will of the creature, and their motion appears under control, and it continually, and always in the manner already described. Like the Floscule, the Stephanoceros is readily alarmed, and retreats into her house, carrying with her the invaginated portion. In the last edition of 'Pritchard's Infusoria,' this case is spoken of as apparently not tubular, but a solid gelatinous mass, enveloping the animal as high up as the base of the rotatory arms. It is very likely that specimens at different ages, and possibly in different seasons, may vary in the structure of their abodes; but I am not able to concur in the preceding account, as all the tubes I examined resembled sacks turned in at the mouths, and attached to the shoulders only of their inmates; and on one occasion I was able to look down into a deserted tube, which had not collapsed, as it would have done if it had been merely a solid gelatinous mass.

Like the Floscule, the Stephanoceros only reveals her beauties under careful illumination. A direct light renders them invisible, and only when the requisite obliquity has been obtained, does the exquisite character of the structure become displayed. The dark-ground illumination is very useful, and makes the ciliary action very distinct. At times a view can be obtained, in which the cilia of perhaps a single tentacle are all ranged like the steel spring of a musical box. For a moment they are quiescent, and then they vibrate in succession, each moving thread sparkling in the light. With a clumsy mode of lighting them, the cilia look like stumpy bristles, and are often so drawn; but precisely the right quantity of light coming in the right direction, makes them appear more numerous, and much longer

than would at first be supposed. When well exhibited the tentacles have a lustre between glass and pearl; the body, in a favorable specimen, is like a crystal cup, and the food, usually composed of small red and green globes, glows like emeralds and rubies, as if in the height of luxury the little epicure had more than rivalled Cleopatra's draught, and instead of dissolving, swallowed its jewelry whole. So lustrous and varied in color is the whole appearance of the animal under these circumstances, that it is frequently alluded to by one of our first artists, to whom it was displayed.

It is said by some authors that the tentacles are used to seize prey. This never occurred under my observation, although their basal portions are often approximated when an object is forced down to the grinding apparatus below. The Stephanoceros is a ravenous feeder, and swallows a variety of creatures. Green vegetable monads, rich red and brown globes of similar characters, and any animalcule that comes in her way is acceptable; and even good-sized rotifers do not escape her all-consuming maw. On one occasion I noticed one of the loricated sort, more than half as long as one of her tentacles, rapidly swallowed, and passed downwards without attempting to escape, Objects much too big for the gizzard are often gulped down, and probably receive a preliminary softening and maceration in the crop. Very often, when food is plentiful, the creature is filled to the brim, but still endeavors to continue her abundant meal. From the presence of large quantities of food and the density of the integuments, the gizzard cannot always be seen; but in favorable specimens its teeth may be observed busily at work.

At the base of the tentacles small masses of matter may be discovered, which are probably nervous ganglia and other organs; and Ehrenberg discovered small vibrating bodies, supposed to be connected with the function of respiration. A single egg, is often found, and the ovarium is said to develop but few at a time. Two red eyes are found in young specimens, but in adults they either disappear or are not conspicuous. The Stephanoceri are sociable animals, and when one is found, others are probably near at hand. Several may often be discovered on the same branch of a small water-plant, of various dimensions, and in different stages of growth. The full size is about 1-36'' in height, and from its magnitude care is required not to crush it in the live-box. When specimens are plentiful, some should be placed in that convenient receptacle; and others with the plant on which they are growing, in a glass cell or trough, where they have more room to display their motions, and can with fresh supplies of water, be preserved for days and weeks. With occasional renewals from one pond, I was able to keep up a stock for about three months, and never had objects which gave more pleasure to myself or to my friends.

Cleaning Engravings.

IT very often occurs that professional photographers have brought to them engravings to copy, and it generally happens that they are old, discolored, and stained in great patches about the color of gingerbread. Of all colors this is, photographically, most objectionable, and it is nearly impossible to obtain a passable result. If the engraving happen to be a valuable one the photographer, as a rule, is almost afraid to try and clean it, lest he should spoil it, especially with the receipts we find published in various receipt books. Only a short time ago I was looking over some of these books. One advocated chloride of lime, another hydrochloric acid, and agents of a similar nature. We all know the bleaching power of such powerful agents. With regard to the first named, I for one, always shun it, as when once it gets in to any organic material it is very difficult to eliminate it again, and it is well known that if any of the lime compounds are allowed to remain the whole fabric, in the course of time, rots and drops to pieces.

I know many amateurs who like this kind of practice in copying old engravings, and are not aware that there is a means of cleaning and restoring them without the slightest possible risk; and, moreover, the plan I am about to propose is a very inexpensive one indeed.

Staining not only occurs in old engravings, but in modern ones we very often see parts of a picture stained sometimes through a knot in the back board, or the wood of the same being full of turpentine. All these markings can be removed. My plan is to get a dish or china tray a little larger than the engraving to be operated upon; if smaller there is a great risk of tearing and damaging the engraving. The bleaching agent is no other than Holmes' ozone bleach. The strength I prefer to any other is one part of ozone bleach to ten of water, well shaken up before pouring into the dish. A much stronger solution can be used—in fact, I have used it as strong as one to five of water; but the reason I use the weaker one is that I am of the opinion that the less of the agent we use the less we have to soak out of the paper afterward. I immerse the engraving in the solution, face upward, avoiding bubbles. The only caution to be observed is that when the engraving is sodden with water it is some-

what rotten; so the less it is handled the better, though I have not the slightest fear in manipulating engravings of the largest size. Sometimes, if the engraving be only slightly stained, half an hour is quite sufficient, but when quite brown I have left them in for as long as four hours. With a stronger solution the time required is much less.

After all the stains are removed, and the paper has regained its pure whiteness, pour the solution out of the dish into a bottle (as this can be used over and over again—that is, several times until it becomes discolored, when it must be discarded), then fill up the dish with water, changing frequently for about two hours, or, better still, place it in running water. When sufficiently washed it can be taken out and blotted off, and then hung up to dry, and, when perfectly dry, I find it advisable to iron on the back with a warm flat-iron; but care must be taken not to have it too hot. When finished it will be as white as the first day it came from the press. The plan is very simple, and my advice is, try it.—*British Journal of Photography.*

Postage Stamp Frauds.

EVERY one must have noticed that periodically there comes up a demand for old postage stamps. People are asked to collect them, and various supremely silly reasons are given as excuses for the request. Now we are told that some one is going to paper a room with them, and that when the room is finished a sum equal to the value of all the stamps will be given to some benevolent institution; at other times we are told that some rich idiot has promised to educate or endow, or do some other kind thing to some young girl if she can collect a million of postage stamps. And at one time we were told that the stamps had a real value, as the mucilage, the dye-stuff used in coloring, and the paper itself all had a superior value.

It is hardly necessary to say that all these statements are false. The stamps are in almost every instance collected for fraudulent purposes. At one time certain parties made a regular business of "washing" stamps and selling them as new. Many of the stamps, however, are so slightly soiled that they can readily be used a second time without any washing. It is also said that certain rogues in the post office use these old stamps to affix to letters from which the clean stamps have been removed. In view of these well-established facts, the *Scientific American* comes to the conclusion that the inventor who can make a really serviceable postage stamp that can be readily applied to an envelope, but which cannot be removed without the total obliteration of the stamp, will have produced a valuable improvement. By a serviceable postage stamp is meant one that will bear reasonable handling without injury, that has no poisonous qualities, that is easily applied, and, as just stated, that cannot be removed intact after it is once put on the letter.

The American Institute Fair.

THE annual fair of the American Institute has been announced, and from the published plans and methods of the managers, we should say that the exhibition this fall will be the best that has been held in many years. The managers seem to have taken the advice of the best friends of the Institute, and propose to make a special feature of processes and manufactures in operation. We have always held that the Institute has a higher mission to perform than to serve as a mere bazaar for advertising and selling goods, though we have no objections to this feature provided it is kept in due subordination to the rest. The American Institute has always been one of the great educational agencies of the city, and this feature should be maintained by all legitimate effort. We are glad to see that the management takes this view of the matter, and we feel sure that both for interest, brilliancy, and instructiveness, the coming fair will be ahead of anything that has yet been held. We hope our readers will make a note of it.

—To wind a watch it is better to turn the hole downward, and let the small end of the key point upward. This will allow any little particles of dirt, metal or dust to drop out, and the watch will not need cleaning so often.

Correspondence.

The Persecution of the English Sparrows.

Ed. Young Scientist.—A most uncalled for and cruel war against the English sparrows is now in progress in almost every part of the United States. This war is based in general upon the following beliefs:

1st. That they destroy the crops.

2nd. That they drive away all birds not belonging to their own species.

The first belief is in part probably true; but if it was not for the English sparrows would the farmers have any crops to destroy? How was it in New York before the English sparrows were introduced into that city? When worms of all descriptions hung from the branches of the trees and dropped on passers by, in like manner would the farmers' crops be treated, and what little damage the English sparrows do to the farmers' crops are amply repaid by the myriads of insects, worms, etc., which they daily destroy. I was reading some time ago a piece in a paper in which the following declaration was made. I do not remember the exact words, but it was very much as follows: "The English sparrow not being an insectivorous bird in the country from which it was imported, it is hardly to be supposed that it will change to an insectiverous bird in this country." The writer of this piece must have been a fool or an idiot, as the English sparrow has already proved itself an insectivorous bird in more than one way.

We will now take the second and most ridiculous belief which a number of very well-meaning folks possess, and that is that the English sparrows drive away all other birds except its own species. This belief is both untrue and unjust. I have often seen English sparrows fighting among themselves, but very seldom have I seen them destroying birds of any other species, while it is a very common thing to see blue-birds, wrens, cat-birds, robins, etc., fighting among themselves, each species endeavoring to drive the other species away.

The following is an extract of a piece which appeared in the *Ogdensburg Journal* of May 31, 1882, and which was reprinted in the *New York Times* of June 2nd. "The sparrow is the most valuable of all birds. While breeding he feeds his young with grubs, flies, insects, bugs, and caterpillars. He is noisy and social, perhaps a little too much so. All the stories about the pugnacity of this bird are false. Any one who has observed the species enough to distinguish the sexes, will, by a little close observation, discover how much he has been deluded about the fighting sparrow." I have written this piece with the hope that the English sparrows may find more favor in the eyes of at least the readers of the YOUNG SCIENTIST.

ALEXANDER G. GIBBS.

The Parasol Ant.

A correspondent from the London *Field*, writing from the Island of Trinidad, W. I., says:

"We were about returning to the boat when one of Mr. B.'s sons, who had been some little distance away from us sauntering about in the bush, called to me to come back, and, on going to where he was, he pointed to what seemed a broad band of moving leaves right across the path, and, on looking more closely, I saw we had met with one of those enormous swarms of the 'parasol ants,' which are so destructive to plantations in the tropics.

"They were crossing from one side of the wood to the other, and were traveling in a column of more than a foot and a half in width; and as each insect carried in its mouth a piece of leaf, which entirely covered the body, they presented a singular appearance, like a Lilliputian grove in motion; and, although we watched them for some time, still they came, their numbers seeming to be inexhaustible.

"Nothing can turn them from their course; and although they be destroyed by the thousands, enough will swarm upon the intruder to make him repent interfering with them. On the mainland of South America I have known a fruit tree stripped in a single night by a swarm of these ants."

Fishing for Rats.

A novel mode of catching rats is thus described in the *American Angler*. The writer says that a person having the patience of most fishermen can have much sport in hooking the vermin.

The warehouse adjoining his place of business is infested by these "file-tails," and our friend may be seen in the early spring, and late fall, on an occasional evening just after dusk, seated at the back window of his counting room (overlooking the yard of the warehouse), with an ordinary rod in hand, strong linen line, and a spring hook, commonly called a "sockdolager," baited with a lump of fresh beef, patiently waiting for a bite. It does not tarry long nor does it consume itself in nibbles, but with a hungry snap the bait is seized and the hooks of the sockdolager impales the rat, when the excitement commences.

A lusty rat is no mean antagonist at the end

of a pliant pole and ten feet of line, and his plunges, twistings, and straight-away dashes are more perplexing to the angler than the leaps, surges, and sulkings of the gamy trout or bass. The rat is generally landed, after seasonable sport, and killed by a blow from a bludgeon.

In this connection we may state that thousands of small hooks are bought by sugar refiners for ratting purposes. The hooks are baited with small pieces of beef on each, and then distributed about the building. The rats swallow beef and hook—the first is digested, the latter is not—death of course results. The remedy is sald to be infallible.

Notes on Belting.

In putting on a belt be sure that the joints run with the pulleys, and not against them. Leather belts should be well protected against water, and even loose steam or other moisture. To obtain a greater amount of power from belts, the pulleys may be covered with leather; this will allow the belts to run very slack, and give 25 per cent. more durability. In punching a belt for lacing, it is desirable to use an oval punch, the larger diameter of the punch being parallel with the belt, so as to cut out as little of the effective section of the leather as possible. Begin to lace in the centre of the belt, and take care to keep the ends exactly in line, and to lace both sides with equal tightness; the lacing should not be crossed on the side of the belt that runs next the pulley; thin but strong laces only should be used. A careful workman will see that his belts are redressed about every four months, by sponging the dirt from them with warm soap and water, then drying with a cloth, and, while still damp, rubbing in castor oil or currier's grease, which will be readily absorbed, the leather being moist from washing. Castor oil has the additional advantage of preventing rats attacking the leather.

Practical Hints.

American Silk Culture.—The Women's Silk Culture Association has given notice of its willingness to purchase cocoons from all parts of the country. Many persons in the South and West have raised cocoons, but have been unable hitherto to find a market for their product.

Growth of Trees.—When timber planting is in order, as it most certainly will be in a few years, it will be desirable to know the rate of growth of different trees, in order to know what will grow rapidly and be serviceable in a short time. Observation tends to show that the growth for twelve years is as follows: White maple, one foot in diameter, thirty feet high; ash, one foot in diameter, twenty feet high; white willow, one and a half feet diameter, fifty feet high; yellow willow, one and a half feet diameter, thirty-five feet high; Lombardy poplar, ten inches diameter, forty feet high; blue and white ash, ten inches diameter, twenty-five feet high; black walnut and butternut, ten inches diameter and twenty feet high.

Diamantine.—Diamantine consists of crystallized boron, the basis of borax. The *Techniker* says that by melting one hundred parts boric acid and eighty parts aluminum, crystals are obtained, the so-called bort, which even attacks diamond. Diamantine bought in commerce is less hard.

Interesting Discovery.—Some fine carvings in ivory, discovered at Nineveh, showed signs of crumbling on arriving in England. Prof. Owen concluded that the decay was caused by loss of albumen in the ivory, and therefore boiled the articles in a solution of albumen. The experiment was a success, and the ivory became as firm and solid as when first entombed.

Tracings on Glass for the Lantern.—The following method, by George Smith, appears to be satisfactory. A piece of finely ground glass is rubbed over with a trace of glycerine, in order to make it as transparent as possible. It is now easy to write or draw on the prepared surface with a hard and finely pointed blacklead pencil, and the glass is so transparent that the finest details of any engraving over which it may be placed can be seen quite distinctly. The drawing having been finished, the plate is washed with water, in order to remove the glycerine, and dried. A thin coat of Canada balsam or of negative varnish now serves to render the slide permanently transparent and ready for the lantern.

Preservation of India-rubber Tubing Under Water.—Mr. Mareck relates his experience of having met with serious annual losses, in consequence of certain kinds of India-rubber tubing soon becoming brittle on exposure. After many experiments, he has adopted the plan of preserving them under water, which he renews from time to time, He found that even the thickest kind of tubing will thus remain soft and pliable without losing elasticity; nor has he found any other drawback by adopting this plan, except this, that they undergo a change in appearance. Red or brown tubing gradually fades, and becomes brownish or grayish-yellow; gray tubing becomes darker and browner externally. A section of tubing reveals the fact that about one-half of the thickness of the rubber, from the outside towards the middle, appears bleached and fatty; but the change is one which is rather of benefit for their practical use. The author adds that very thin rubber bands, with which other goods were tied, became so soft that they could be rubbed to small crumbs with the fingers.—*Dingler's Polyt. Journ.*

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business matter in letters or cards they are filed away and never reach the printer.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

Wanted engraver's tools with book of instructions, for a Victor Press, with cabinet, 2 type cases, type, ink roller and furniture complete; perfectly new. L. Warren, 72 Cumberland St., Brooklyn, N. Y.

A Fletcher Foot-Blower, cost $5, as good as new; will exchange for a Cushman, 2 in. or up scroll chuck, or other make; will give a satisfactory trade on the difference in price, if any. Louis Lutz, St. Clair Street, Toledo, O.

I have a lot of "Galaxy" (magazines) which I would like to exchange for an air rifle in good condition, a collection of birds' eggs, or offers. W. B. Greenleaf, 480 La Salle Ave., Chicago, Ill.

I have a Mechanical Telegraph with book of instructions, books, etc., which I wish to exchange for good microscopical objects, mounted on 3 x 1 slips. Address, with list, J. H. Frey, Millersburg, Ohio.

To exchange, "How to Use Microscope," Wells' "Natural Philosophy," and many other books, chemical apparatus, etc., for good photographic camera, and lenses. W. H. Weed, 254 Putnam Ave., Brooklyn, N. Y.

Wanted "Quimby's New Bee Keeping," for "Our Own Birds of the United States," by W. S. Baily; new. Joseph Anthony, Jr., Colota, Whiteside Co., Ill.

Wanted a good book in anatomy, in exchange for a book on chemistry, or for story books. A. G. G., Box 26, Summit, New Jersey.

A German-silver trimmed, patent lined, cocoa flute, cost $4, in good order, for good spy-glass, photo-material, or offers. Ewing McLean, Greencastle, Ind.

I have some fossil shells from the west bank of the Mississippi, to exchange for Indian relics. A. W. S., 187 E. 71st St., N. Y.

I have a magic lantern, Ruby pattern, nearly new, and 5 views; also "Our First Century," bound in leather, cost $7; state what is wanted in exchange. I. N. Spencer, Box. 217, So. Manchester, Conn.

First-class telegraph instrument and attachments, and "Wood's Botany," for bound volumes of periodicals, books, or offers. H. P. Albert, Anderson, Iowa.

Wanted a book on treatment and care of canary, also breeding of same; will give in exchange book named "Market Garden, Flower Garden and Bees," or 40 "Scientific Americans" or "Seaside Libraries;" want also old books. M. J. Mulvihill, Norwalk, Conn.

Coins, minerals, stamps, books, type, fishing tackle (very complete) and fish pole, bronze inkstand, etc., for coins, medals, stamps, war envelopes, old newspapers, and Continental, Colonial and Confederate currency. F. F. Fletcher, 103 Main St., St. Johnsburg, Vt.

Blow-pipe set (cost $10), large illustrated family Bible (cost $7.50), for Wood's Botany, Dana's Geology, or printing press and type. H. W. Noble, Box 134, South Dansville, N. Y.

Wanted, offers for fossil shells from the west coast of Africa. A. W. Seward, 187 E. 71st St.

I have a number of birds' eggs I should like to trade for other birds' eggs; send for list of trading eggs. A. G. G., Box 26, Summit, New Jersey.

For a microscope stand or offers, a 36-inch turning lathe (new) and a number of scientific books; send for list. A. Kendall, Somerville, Mass.

Wanted services of amateur printer with small office (or large), in exchange for an interest in a well-established weekly paper, good size. Eagle Office, Plymouth, N. H.

American Agriculturist microscope, new, cost $15, for amateur photographic apparatus, lever watch, 22 calibre breech-loading sporting rifle or magic lantern of equal value. Wm. A. Walker, Rockland, R. I.

I. T. Bell, Franklin, Pa., has back numbers of Scientific American, Forest and Stream, and Young Scientist, good flute, chessmen, books, etc., for good magic lantern, revolver, scarce coins, or offers.

A steel spring bracket-saw, 2 doz. saw blades, and about 1 doz. patterns for a good stylographic pen or offers; send postal before exchanging. Geo. Oakley, Rutherford, N. J.

A rosewood banjo, 11 inch head, 12 nuts, fully strung, together with lot of dime banjo music and instructions, for microscope, Webster's Unabridged, monkey, squirrel and cage, or offers. J. DeWitt Clark, P. O. Box 37, Brooklyn, N. Y.

For self-inking printing press and type, one Henry rifle, 16 shot, 44 cal., cost $40, in good order, or one double barrel shot gun, barrels London fine twist, or offers. J. B. Garrison, Belton, Bell Co., Texas.

A new 40 diameter microscope, corals, and minerals, for a stylographic pen, air gun, or offers. J. McBride, 54 Garley St., Chicago.

What offers for "The Chefs D'Oeuvre D'Art, Paris Exhibition 1878," cost $16, good as new, bound; 1 large photo camera, complete, cost $95; Scientific American from 1859 to 1880, 4 vols. bound. D. Keesler, Stony Point, N. Y.

Sea shells of Atlantic coast, scientifically marked, for books, old or new magazines, Indian relics, natural history specimens, apparatus; anything. Wilfred Leon Miller, P. O. Box 392, Cape May, N. J.

A dulcimer that cost $20, books and fossils, for a telescope, microscope, fossils, Indian relics, or offers. E. J. Votaw, Salem, Iowa.

A self-inking model press, 5 x 7½, cost $23; $90 worth of scroll-saw designs in lots to suit; Scientific American, 1880; Palliser's Useful Details, $3; for photo outfit or offers. C. H. Parker, Coldbrook Springs, Mass.

Telegraph key and sounder, Frank Leslie's Illustrated Magazines, mounted microscopic objects, natural curiosities, for bull's-eye condenser, photograph camera, Unabridged Webster Dictionary, or offers. W. T. Alan, Greenville, Mercer Co., Pa.

Large magic lantern, spectroscope, pantagraph, for enlarging drawings, rosewood writing desk, man's saddle, for microscope, photo outfit or offers. Thomas Walters, Bergen St., East of Brooklyn Ave., Brooklyn, N. Y.

Model card press, chase 3¼ x 5¼, with 4 fonts type, cases, etc., for good foot lathe. Mills Day, 2 Farmington Av., Hartford, Ct.

French microscope, inclines to any angle, delicate fine motion, neat upright case, cost $17.50, for scientific books; send list to W. Fitz, P.O. Box 2852, New York.

Wanted, Quinby's New Bee Keeping, for Our Own Birds of the United States, by W. S. Baily; new. Joseph Anthony, Jr., Coleta, Whiteside Co., Illinois.

Printing type, small pica; large and small capitals, and small letters; 60 to 65 lbs., including two large cases; also gothic nonpariel, for trade. J. Siler, 1242 Broadway, St. Louis, Mo.

One years' copy of Aldine, cost $5.50, and German accordion, with instructions how to use it, cost $5.00, for offers. Chas. Dempwolf, 86 Benson St., Paterson, N. J.

A Novelty printing press, with type, prints a form 5 x 7 inches, cost $40.00, for a microscope, photographic apparatus, or offers. T. W. Patterson, Warsaw, N. Y.

$80 worth of (nearly new) printing material, minerals, fossils, Aboriginal relics, etc., for scientific books, good American watch, and offers. F. M. Farrell, Cobden, Union Co., Ills.

Rocks, minerals, fossils and fresh water shells for microscope stand, $20 to $75, also for objectives, turning lathe type, and tools. D. D. Babcock, South Dansville, N. Y.

Magic lantern, in good order, condensing lens, 2½ in. diameter, 8 slides. For small photographic camera or offers. H. A. Giddings, 4 Union Place, Classon Ave., Brooklyn.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

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Scientific Drama.

ONE of the latest attempts to popularize science consists in the presentation of a drama which embodies the history and illustrates the principles of some great scientific discovery. Figuier, so well known as a popular scientific writer, has written a historical play, in which is set forth the discovery of the steam engine, and the history of one of the early inventors, Denis Papin. From the *Industrial News* we quote the following account of this play:

"It is illustrated in eight tableaux, and the author, while adhering to correct historical data for the principal events, has interwoven such details of romance as to satisfy the supposed requirements of a drama in the matter of a plot. Papin, the learned hero, being a Protestant, is by the revocation of the edict of Nantes, by Louis XIV. compelled to leave Paris. He goes to London and marries the daughter of a rich brewer, by whom he has two children. Pursued by a never ceasing desire for scientific discovery he forsakes his wife, and taking his daughter and an old servant with him, repairs to Germany to consult with the learned men of Marburg University. In the third scene we are introduced into Papin's laboratory, where he has already spent some years endeavoring to discover a 'universal motor.' He has just tried gunpowder with only partial success, when the boiling of an iron pot full of soup suddenly turns his attention to steam. Assembling his colleagues Papin introduces a jet of steam into a long iron cylinder, and forthwith succeeds in raising a heavy weight with a man hanging on to it. He next applies his invention to a boat, and intends sailing it down the Weser and over the ocean to England. And the historical fact is here introduced that the boatmen of the Weser, fearing that their business will be interfered with by that which they call an invention of

Satan, attack and destroy the steamboat, and are only prevented by the timely arrival of some Hanoverian soldiery from murdering Papin, his daughter and a German student to whom she is betrothed. The unfortunate man returns to London where his wife has died during his absence. He is now plunged in the most abject poverty, without food. The daughter dies, after seeing for a few moments her lover, who comes from Germany with brilliant proposals to Papin from the University of Marburg. These he declines, but on hearing that a blacksmith named Newcomen is making steam engines at a place called 'Darmouth,' he goes thither, accompanied by the student Hermann and another German friend. The blacksmith turns out to be the son of Papin, who thought that the youth had perished in a fire at his grandfather's brewery some years previously. Papin does not make known his relationship to Newcomen, but assists him to construct a huge steam pump ordered by the Lord Mayor of London to provide the city with Thames water.

The final tableau shows this enormous machine, a beam engine, majestically pumping up Thames water, while the Lord Mayor, surrounded by red-coated guards, assists at the inauguration ceremony, which is enlivened by the strains of 'God Save the King.' Newcomen, who reaps all the honor of the invention, generously ascribes a share to Papin; but their mutual satisfaction is short lived. For some incomprehensible reason Papin's old enemies, the Weser boatmen, appear on the scene; they cut a rope connecting the cylinder of the engine with the beam. The machine stops working and the boiler threatens to burst. Papin gallantly breaks open the safety valve and is mortally wounded; but the machine blows up nevertheless, and amid a shower of sparks and red fire the hero sinks down dead, after disclosing his identity to his son.

It is said that the play is not a success and that it does not promise to be popular. The reason of this may be found in the attempt of the author to disguise scientific instruction too much in the garb of a novel; or it may be that the public has yet to be educated up to the point where they will as willingly go to a place where they can receive instruction, as to a place where they are merely attracted by the amusements offered. Let science be made attractive to those who are not yet elevated to the level of finding science attractive in and of itself."

Save the Flowers.

BY A. W. ROBERTS.

I HAVE often wondered, as the winter evenings draw nigh, why some of our young folks have not thought what a good thing it would be if we could take up and preserve the thousands of beautiful flowering and foliage plants that have adorned our yards all summer long, and are doomed to perish by the frost if not cared for. How many cheerless and scantily furnished homes might be made

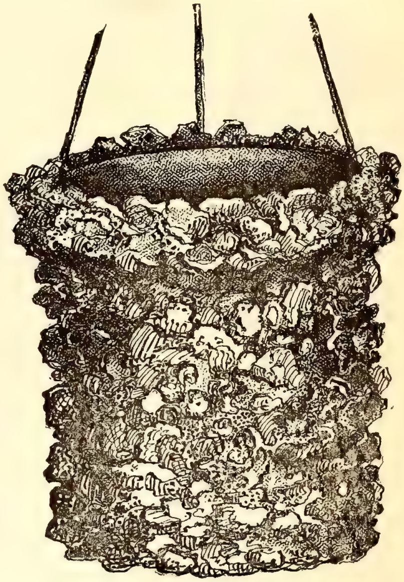


Fig. 1.

to bloom if these same flowers (which I have noticed in the large cities are in the great majority of cases left to perish) were taken up and placed in home-made or cheap earthenware pots. Then there are our numerous charitable institutions

for sick and poor children. One of the cheapest and most easily constructed of home-made flower pots, is that shown at Fig. 1, which is intended for a hanging flower pot, and is constructed out of an empty tomato or peach can. A can, when used for growing, should be thoroughly coated on the inside with asphalt varnish to save it from rusting at the joints. In this case the can is coated both on the inside and outside with asphalt varnish.

Fig. 2.

To the sides of the can clinkers are fastened by means of melted asphalt (such as is used for roofing). These clinkers can be obtained of various shapes and colors from the furnaces of engine rooms or glass houses. It is best to avoid what is known as "slag," that is produced in iron foundries, as it is a very heavy material, and is apt to become rusty in course of time. As will be seen by the figure, the clinkers attached to the rim of the can are much larger in size, and project beyond those on the body of the can. This is done to break up the otherwise stiff uniformity of the outline. It must be borne in mind that without the outside coating of asphalt varnish it is almost impossible to attach the clinkers to the can, as the hard asphalt when applied to the tin of the can will not adhere to it. In case the clinkers do not appear brilliant enough in color, they can be touched up here and there with cheap oil colors. When plants are very large it is always best to make use of cuttings. Much that is of interest in plant life may be learned from the starting point of a rose or geranium slip or cutting, how the "callous" is first formed, and its gradual development into roots, and how, when a sufficient number of rootlets are at work supplying and conveying food for the cutting, the leaf buds begin to unfold and develop into leaves, and so on till the

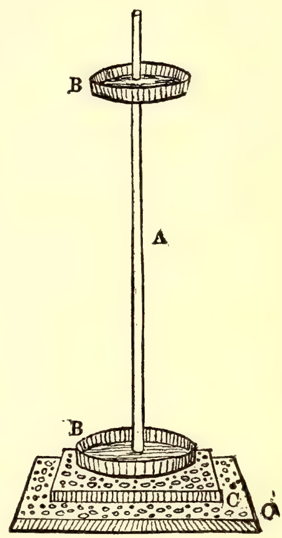


Fig. 3.

flower buds and perfect flowers appear. When shifting flowers from the garden to indoors it is always best to allow them to "season off" for a few days before introducing them into a room.

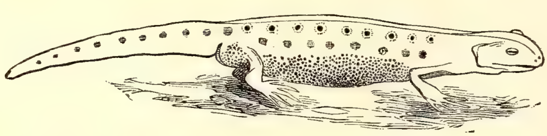
I have always found pots containing living plants and flowers very useful as a

means of ornamentation when placed in picturesque masses and groups at winter evening gatherings of children or children's parties. When mosses and berries and fern leaves are obtainable from the woods, nothing can be more elevating and pleasing than the floral effects that can be obtained at a small outlay of money and taste. On the tea or supper table at a winter's entertainment, I believe in a lavish use of both cultivated and wild floral material.

As a simple, cheap, and easily made central ornament for a table, I can highly recommend the one shown at Fig. 2. The upright, A, Fig. 3, consists of a stout glass rod, either solid or hollow, which can be obtained of manufacturers of glass chemical apparatus, also of thermometer makers, or dealers in glass birds' eyes and fancy glass goods. This rod is twenty-four inches high. The top and bottom pans consist of fruit cans cut down to the depth of two inches. In the bottoms of these pans a hole is punched, through which the glass rod passes. When a glass rod is not obtainable, a rustic upright one can be used. In some respects I prefer it to a glass one, on account of its durability and less likelihood to breakage. When using a rustic upright, always select a wood that has strong character, either of color or bark. It is entirely correct to attach small fungi, lichens, insects of brilliant colors, or butterflies. The upper end of the rod extends above the pan a distance of six inches, and is for the purpose of fastening the heavier fronds of ferns, etc., to it with fine thread. The lower end of the rod passes through two pieces of board, C C. After the rod is in position, the pans are cemented to the rod by pouring hot asphalt about the holes in the pans where the rod passes through; this is done for the purpose of making the pans water-tight. Hot asphalt is also used where the end of the rod passes through the two boards. The pans are filled with damp moss, in which the vines, ferns and flowers are placed. Small and large holes are bored into the two boards; into these holes damp moss or sand is also placed, and flowers, etc., are inserted. To prevent the wood work of the stand from warping or decaying, two or three heavy coats of a light-green paint must be applied.

Newts for the Aquarium.

WATER lizards, newts or tritons are the common names by which the animal shown in our engraving is called by the different dealers. *Triton millepunctatus* is the most common species of newt in North America. They are to be found in every clear pond, and more particularly in those ponds containing aquatic vegetation. They are perfectly harmless, and since the introduction of aquaria as a home adornment, the great prejudice that at first existed against them has nearly passed away. The newt, like other reptiles, casts his skin and goes through no less than nine different stages of being from the time of his first appearance from the egg to the end of his life mission. They feed upon earth worms and minute aquatic insects, and as they enjoy a gambol on dry land as well as in the water, the tank in which they are kept should be so arranged that they can leave the water to enjoy an air bath. This is easily accomplished by piling a few rocks above the surface of the water, and, if the position of the aquarium will allow it, the top of these rocks should be so arranged



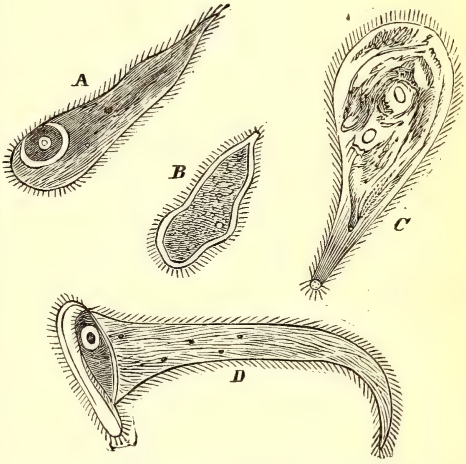
TRITON MILLEPUNCTATUS.

that the sun's rays may occasionally strike it, for a sun bath as well as an air bath is a great luxury to all aquatic reptiles. At the same time great care must be taken not to allow the newts to escape, which they will undoubtedly try to do, and as they never succeed in finding their way back, they die a lingering and miserable death. A glass frame, with walls about five inches high, confines them effectually. This frame need not be water tight, but no rough framework should present a foothold for the reptiles, and no overhanging leaves of lilies or other water plants should afford them the means of dropping over the sides.

Marvels of Pond Life.—XII.

OCTOBER, the finest of our autumn months, is noted for usually granting the inhabitants of our dripping climate about twenty pleasant sunshiny days, and it is probably on this account somewhat of a favorite with the infusorial world, although the cold of its nights and early mornings thins their numbers, which reach a maximum in the summer heat. Even in the dismal year 1860, October maintained its character, and afforded a great many opportunities of animalcule hunting, during which a constant supply of Stephanoceri were readily obtained, together with swarms of *Stentors*, which are not exceeded in interest by any of the Ciliated Protozoa. The Stentors were abundant on the same weed (*Anacharis*), that formed the residence of the Stephanoceri, and might be seen in large numbers hanging from it like green trumpets, visible to the unassisted eye. In the 'Micrographic Dictionary' they are said to belong to the Vorticella family, which has already given us several beautiful objects and possess a marvellous power of changing their shape. It is, however, better to follow Stein, who separates them from the Vorticellids and ranges them in his order Heterotricha, as they have two distinct sets of cilia, small ones covering the body and the larger ones round the mouth. Those before us are named after this property *Stentor polymorphus*, or Many-shaped Stentors, and owe their exquisite tint to numberless green vesicles, or small cavities filled with coloring matter like that of plants. This, however, is not essential to the species which may often be found of other hues. In size this Stentor varies from a hundred and twentieth to one twenty-fourth of an inch. It is entirely covered with fine cilia disposed in longitudinal rows, and round the head is a spiral wreath of larger and very conspicuous cilia leading to the mouth.

Having observed the abundance of these creatures, a few small branches to which they were appended, were placed in the glass trough, and viewed with powers of sixty and one hundred linear. Some had tumbled down as shapeless lumps, others presented broad funnel-shaped bodies; while others stretched themselves to great length like the long, narrow post-horns which still wake the echoes of a few old-fashioned towns. The ciliary motion of the elegant wreath was active and rapid, causing quite a stir among all the litttle particles, alive and dead; and when the right sort of food came near the corkscrew entrance to the mouth, down it went, and if conspicuous for color, was subsequently seen apparently embedded in little cavities, which Ehrenberg supposed were separate stomachs, although that theory is now rejected. One advantage of viewing these objects in a sufficient quantity of water,



A, B, C, D, Stentor polymorphus in different degrees of expansion. A large specimen is one twenty-fourth of an inch long.

to leave them in freedom, is that they frequently turn themselves, so that you can see right down into them. To make out the details of their structure, to see the nucleus and other organs, the flattening in the live-box is useful, and it enables much higher powers to be employed.

After leaving the Anacharis in a glass jar for a few days, the Stentors multiplied exceedingly; some clung to the sides of the vessel in sociable communities, others hung from the surface of the water, and crowds settled upon the stems, visibly changing their tint, as the Stentor green was much bluer than that of the plant.

Scores swam about in all sorts of forms. Now they looked like cylindrical vessels with expanding brims, now globular, now oddly distorted, until all semblance of the original shape was lost. Many were found in shiny tubes, but these were never so lively or green as the free swimmers, but mostly of a dingy dirty hue.

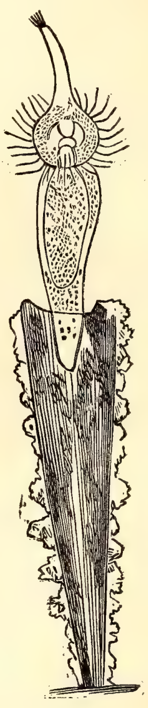
These housekeepers were more timid and cautious than the roving tribe. They came slowly out of their dens, drew back at the slightest alarm, never took their tails from home, and only extended their full length when certain not to be disturbed. Some authors have thought they only take to private lodgings when they feel a little bit poorly, but others dispute this opinion, and I do not think it is correct. I have found these Stentors at all seasons, from January to the autumn, but they are never so numerous, nor aggregated in numbers like the roving sort. Whether they are old folks, who are tired of the world and its gaieties, and devote the remainder of their lives to contemplation, or whether they are bachelors disappointed in love, I am unable to say; but they are very inferior in beauty to the "gay and glittering crowd."*

For some weeks my Stentors abounded, and then most of them suddenly disappeared. They could not have "moved," but probably "went to smash" by a process peculiar to infusoria, and which Dujardin politely describes as "diffluence." This mode of making an exit from the stage of life is more tragical than the ripping up so fashionable in Japan. The integument bursts, and its contents disperse in minute particles, that in their turn disappear, and scarcely leave a "wrack behind."

The Stentors obey the injunction to "increase and multiply" by self-division, which Stein says is always oblique, and the nucleus, which plays such an important part in infusoria, is band-like, moniliform (bead-shape), or round. When an animalcule increases by self-division, a portion of the nucleus goes with each part, and it is probably the organ which stimulates the change. It is also concerned in other modes of propagation. "The anus is situated on the back, close beneath the ciliary circle;" and the "contractile vesicle on a level with the ciliary wreath." Stein records that in November, 1858, he met green Stentors (*Polymorphus*) encysted, and he figures one in a gelatinous flask having a stopper in its narrow neck.

Before closing our account of the Stentor, let us revert a moment to the ciliary wreath, as it may be made the subject of a curious experiment. If, for example, the cilia are viewed at right-angles to their length, they will seem to form a delicate frill, in which a quivering motion is perceived. But if the table is shaken by a sharp blow, the frill is thrown into waves, or takes the form which washerwomen give to certain articles of female apparel by the use of the Italian iron, and the ciliary motion is thus made to take place in different planes, and rendered strikingly apparent.

One day turning over the Anacharis in search of subjects, a small brown tube was noticed, from which a glassy rod protruded like the feeler of a rotifer. Keeping the table quiet, and watching the result, was soon rewarded by a further protrusion of the feeler, accompanied by a portion of the body of the inmate of the tube. The feeler was thrust on this side and on that, as if collecting information for its proprietor, who, I suppose, was satisfied with the intelligence, and gradually extended herself, until she stood out two-thirds in length beyond the tube, and set two lobes of one nearly continuous ciliary organ in rapid motion. Sometimes the creature, *Cepha-*



× 180.

Cephalosiphon limnias.

* Stein says the colorless variety of S. Polymorphus is sometimes found with a tube, and the S. Rossellii very frequently so provided.

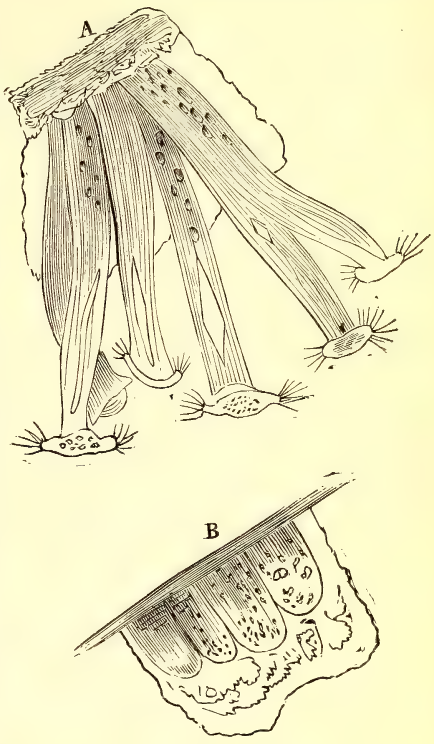
losiphon limnias, bent its neck, if I may so speak, to the right, and sometimes to the left, and sometimes stood upright, when the true form of the ciliary apparatus could be seen. The tube of this creature was opaque, from the adhesion of foreign matter, and presented an untidy appearance, strangely contrasting with the clear, neat bottles of the Floscules. These Cephalosiphons are very whimsical in their ways, and many that were sent to different observers never exhibited their ciliary wreaths, but performed sundry antics, disguising their true shape.

Somewhat like the Cephalosiphon, though much commoner and without the siphon, is Limnias ceratophylli, which every collector is sure to meet. The length of the Limnias varies, according to Pritchard, from 1-20′′ to 1-40′′. Our Cephalosiphon, when fully extended and magnified one hundred and eighty linear, looked about three inches and a half long, and was therefore very small. Just below the ciliary lobes the gizzard was seen, with its toothed hammers working one against the other. The masticatory organ differs from the typical form, as represented in the Brachion; and Mr. Gosse observes of Limnias that "each *uncus* forms, with its *ramus*, a well-defined mass of muscle enclosing the solid parts, and in form approaching the quadrature of a globe. Across the upper surface of the mass the *uncus* is stretched like three long parallel fingers, arched in their common direction, and imbedded in the muscular substances, their points just reaching the opposing face of the *ramus*, and meeting the points of the opposite *uncus* when closed."*

There is no connection between Limnias or Cephalosiphon and their tubes, except that of simple adhesion, which takes place by means of the end of their foot-stalks.

In a former article we have described an interesting relation of the Vorticella, the Cothurnia, whose elegant crystal vases form a very artistic abode, characterized by possessing a distinct foot. Other species of the same family inhabit vases which have no foot or stalk, or live in gelatinous sheaths less accurately fashioned. Sometimes these creatures are obliging enough to conform to the specific descriptions which eminent naturalists have given of them, and also to the characters which the authorities have assigned to the different genera in which they have been grouped, but the microscopist will often meet with difficulties in the way of classification.

Attached to a piece of weed were a number of cylindrical masses of brownish jelly, with rounded tops, and situated in an irregular and very transparent sheath, about twice as high as themselves. Presently they all rose up to four times their previous height, put forth a beautiful crown of vibrating cilia, and opened a



× 240.

Vaginicola (?) (A, elongated; B, retracted).

sort of trap-door to their internal arrangements. In this position they had a long cylindrical form, gracefully curved; but of nearly equal width from the mouth to the base, and they readily imbibed particles of carmine, which tinged sundry little cavities with its characteristic hue. The slightest disturbance caused the ciliary wreaths to be drawn in, and the bodies to be retracted, and descend into their house like a conjuring toy, until the appearance first described was reproduced.

The general form and structure of these objects was like the drawings usually given of *Vaginicola*, which is said not to exist in groups, although two individuals are commonly found in one well-shaped cell. These creatures, however, did not taper towards the base as Vagini-

* The term *uncus*, *ramus*, etc., have been explained in a former number.

colæ generally do, and perhaps they became aware of this defect in their figures, for after a day or two a change appeared, and they assumed a more graceful form by swelling out in the middle, and then growing slender down to the bottom, very much like the pattern given by glass-blowers to little vases of flowers.

It is very important to note the changing appearance of animalcules, and where the same individuals can be observed from day to day, these will often be found considerable. It is probable that when such particulars are fully known, the number of species will be greatly reduced, and the study of these organisms considerably simplified. I have called the animals just described *Vaginicolæ*, but the reader must be prepared to find similar bodies, inhabiting well-formed vases, either solitarily or in couples, the latter condition arising from the fission of one individual without a corresponding division of the abode.

For a few weeks I continually met with groups living as I have described, in what may be called amorphous cells, which were often so nearly like the surrounding water in refracting power, as to be discerned with some difficulty. No trace could be seen of divisions into separate cells, but they all appeared to live happily together in one room, and if one went up all went up, and if one went down all went down, as if their proceedings were regulated by a community of sensation or will.

Another little curiosity was a transparent cup upon a slender stem, which stood upright like a wine-glass, and supported on its mouth a transparent globe. By removing a leaf which prevented the stalk being traced to its termination, it was found to be a Vorticella, and after two hours the globe was partially drawn in, and reduced in size. Why the creature was engaged in blowing this bubble I do not know, and have not met with another instance of such conduct.

Executing Criminals by Electricty.

THE adoption of electricity as a mode of capital punishment has enthusiastic advocates in Germany, as well as in France, as witness the following imposing description of a method proposed by a German writer: "In a dark room, draped with black, and which is lighted only by a single torch—the chamber of execution—there shall stand an iron image of Justice with her scales and sword. Stern Justice is popularly supposed to have no bowels, but this German goddess will carry a powerful electric battery in her inside; and this battery will be connected with an arm-chair—the seat of death. In front of the chair shall stand the judge's tribunal, and only the judge, jury and other officers shall be present with the criminal during the ceremony of the execution. This will consist in the judge reading the story of the crime committed by the prisoner, who will be rigidly manacled to the aforesaid arm-chair, and when this is done, the judge will break his rod of office and toss it into one of the scale-pans of Justice, at the same time extinguishing the solitary torch. The descent of the pan will complete the electric circuit, and shock the victim into the next world."—*Iron.*

Non-Poisonous Pharaoh's Serpents.

IT is well known that the ordinary Pharaoh's serpents are exceedingly poisonous, not only in the form of powder, but from the vapors which they give off when burned.

Dr. Puscher gives the following directions for preparing Pharaoh's serpents, that are not attended with injurious fumes: Mix intimately two parts of bichromate of potassa, one part of nitrate of potassa, and three parts of white sugar. This mixture should be pressed in paper or tinfoil cones, and, if intended to be kept for any length of time, the paper should be varnished over with sandarac varnish. A small quantity of balsam of Peru may be added to perfume the mixture, so as to cause its combustion to be attended with a pleasant odor. The greenish-colored very porous mass, which assumes the serpent shape, is a mixture of carbonate of potassa, oxide of chromium, carbon, and a small quantity of neutral chromate of potassa. The author states that this mass is an excellent substance for polishing all kinds of metals, and may be, moreover, usefully employed as an absorbent for moisture, instead of chloride of calcium, since, without becoming pasty, it absorbs, in twenty-four hours, about twenty per cent. of moisture. The mixture above specified should be kept in a dark place. We have seen this mixture tested with very excellent results.

A Curious Feat.

PROFESSOR COLLADON, of Geneva, recently described a curious and little-known experiment, showing the great resistance which the air, under certain circumstances, offers to the motion of bullets in guns. It resembles a feat that was sometimes performed by soldiers with the old Swiss carbines. M. Colladon fully charged with compressed air the hollow iron breech of an air-gun, which served as a reservoir. The barrel being then screwed on, he introduced a

round lead ball, running freely, but nearly filling the bore; then, placing the gun vertical, he seized the upper end and pressed his thumb forcibly on the mouth. The gun was then "fired" by an assistant; the thumb remained in position, and the ball was heard to fall back in the bore. Thereupon, after recharging the weapon with the same ball, he shot the latter at a pine board about 1 inch thick or a pane of glass, and it passed through. The experiment, M. Colladon says, is without danger, if the operator is quite sure of the strength of his thumb, if the gun is more than 32 in. long, and if the ball is spherical, and nearly fills the gun, in which it must act like a piston.

Nature's Dressing for a Wound.

A FEW years since, while standing in the shade during the heat of the day, a toad hopped along at my feet and attracted my attention from having what appeared to be a very large forearm. Stooping down, I found that from the shoulder to the elbow-joint the fore-leg was encased in earth, which was very smooth, dry and hard. Inquisitiveness being well developed, I had, of course, a natural inclination to see what was inside, so holding "toady," with a piece of stick I broke the crust of hardened mud, and found, to my surprise, a large flesh wound extending from the shoulder to the elbow, half of the muscle being bruised and raw. From the smoothness of the work, I judged the dressing had been made from dry earth and the spittle of the toad, as it would be seemingly impossible for it to handle mud and apply it in such a manner.

I thought nothing more of the matter for a year or more, until one night one of my children retired with a very sore toe from some unknown cause, and about midnight was wild and restless with pain. I arose and opened the ulcerated part, and afforded him relief for the time being; but the pain returned, and by the next hour he was as restless as ever. After trying to give relief in various ways I thought of the toad, and, taking an old stocking, I put some mud, made of clay and water, into the toe part, and drew it on the child's foot. In 10 minutes he was asleep, and slept well the remainder of the night, and in the morning the toe appeared nearly well.

I have found that a mixture of earth and spittle is preferable, and I have used it since upon every occasion where remedies are necessary for the relief of ulcers or healing flesh wounds, and prefer it to any ointment or liniment that I have ever seen or made during many year's experience as a druggist.—*Correspondent of Phrenological Journal.*

The Effect of Printer's "Display."

A CURIOUS case came under the notice of the English inspectors of explosions of a quantity of honey which was imported into England in packages, bearing a label which, at first sight, conveyed the impresion that they contained dynamite, and a good deal of alarm was excited, and the attention of the Lord Mayor was called to the circumstance that cases containing apparently a dangerous explosive were being conveyed about London. However, on investigation it appeared that the honey was in the comb, inside boxes, the tops and bottoms of which consisted of thin sheets of glass, and several of these were enclosed in a large outer package. It was, of course, necessary that the packages should be very carefully handled, and in order to secure this the importers had had recourse to the extraordinary device of placing upon each package the label: "Handle gently as dynamite. A drop of one inch will cause certain destruction to the contents." The words "handle gently," "dynamite" and "certain destruction" being printed in much more prominent type than the rest, the label presented the appearance described. As the use of a label of this sort did not constitute an offence agaist the explosives act, the inspectors did not further concern themselves in the matter.

To Bleach Bones and Skeletons.

BONES may be bleached in several ways, though, in the main, the methods do not differ very much from each other. In the first place, it is necessary to get rid of all extraneous matter, such as attachment of ligaments, muscles, etc. Next they may be laid for several months in cold water, after which they should be boiled with weak lye. Instead of macerating them in cold water, they may be treated with lye at once, but it is not so easy to get rid of the fatty matter in this manner. Some others do not use potash at all; but, after having boiled the bones in water, they dry them, and then place them in naphtha for several weeks. After the fat has been extracted, they are generally white enough for all ordinary purposes. Still, they may be rendered whiter by immersing them for about twelve hours in a moderately dilute solution of chloride of lime (1 part of chloride of lime mixed with 50 parts of water, and strained). Finally the bones must be washed with water until the latter has completely exhausted every trace of chemicals or solvents employed on them. All bones do not stand treatment with potash equally well; the more slender, frail, and flexible a bone,

the less potash it will bear. In fact, tender bones should be bleached without this agent.

Observatory on Mount Etna.

THE following forms part of an account of this observatory, given by Signor Tedeschi: The observatory is built on a little eminence, on the side of the central crater of Etna, a position which makes it almost certain that should a stream of lava issue on that side, it would divide into two streams, and flow harmlessly on each side of the little hill. The building consists of two stories, the joint height of which is nine metres, and the base of the edifice occupies a superficial area of 200 square metres. In each story there is a circular room surrounded by other chambers destined for different uses. In the centre of the circular room in the lower story there is a solid pillar to support the great refractors. All the instruments, as well as a fine collection of seismographic and meteorological apparatus, are in the upper story, in the large circular room of which are the telescope and chronometrical apparatus. This room is roofed with a movable iron cupola. In this story are also the rooms for foreign visitors, and a little terrace, from which there is a view of half Sicily, Malta, the Lipari islands, and part of Calabria. The observatory on Etna is the highest building in Europe. The observatory on Vesuvius is 619 metres above the level of the sea, the Hospice of the Gotthardt, 2,075 metres, and that of St. Bernard 2,491; while the Etna observatory is at the height of 2,942 metres. At this great elevation there is no fear, in taking astronomical and spectroscopic observations, of the perturbations proceeding from the variable density of the different atmospheric strata, so that this observatory will probably render invaluable service to astronomical science and terrestrial physics.

Sound.

The following curious observations of sound have been carefully verified by an extended series of experiments: The whistle of a locomotive is heard 3,300 yards; the noise of a railroad train, 2,800; the report of a musket and the bark of a dog, 1,800; an orchestra or the roll of a drum, 1,600; the human voice reaches to a distance of 1,000; the croaking of frogs, 900; the chirping of crickets, 800. Distinct speaking is heard in the air from below up to a distance of 600 yards; from above, it is only understood to a range of 100 yards downwards. It has been ascertained that an echo is well reflected from the surface of smooth water only when the voice comes from an elevation. Other similar phenomena connected with the transmission of sound have been observed, but the results disagree, either from inaccuracy in the observations or from the varying nature of the circumstances affecting the numbers obtained. Such variations occur to an extent of 10 to 20 per cent., and even more. The weather being cold and dry, or warm and wet, are the chief influencing causes. In the first case the sound goes to a greater, and in the second to a lesser distance.

Seeing and Signaling.

M. Charpentier tells us that the time elapsing between a person seeing a signal and being able to repeat it with his forefinger is about thirteen-hundredths of a second. With some people the interval is twice as long, but the above may be taken as the average. M. Charpentier terms the interval in question the "duration of luminous perception," and he measures it in a very ingenious manner. A black disk is set revolving at a given speed, and the observer faces it, having under his finger an electric key. There is a small opening or window in one part of the disk, and when this comes round opposite the observer he sees a light shining through it. Immediately he presses the key and an electric signal passes to the revolving disk. The disk is stopped, and the distance between the window and the record of the signal being measured furnishes the result. The distance between the two points on the disk is, of course, easily turned into time, since the disk was revolving at a known speed.

Minute Workmanship.

The Salem Museum, Massachusetts, has in its possession a cherry stone containing one dozen spoons. The stone is of the ordinary size, the spoons being so small that their shape and finish can be distinguished only by the microscope. This is the result of immense labor for no decidedly useful purpose, and there are numbers of other objects in existence the value of which may be said to be quite as indifferent. Thus, Dr. Oliver gives an account of a cherry stone on which were carved one hundred and twenty-four heads so distinctly that the naked eye could distinguish those belonging to popes and kings by their mitres and crowns. A Nuremberg top maker inclosed in a cherry stone which was exhibited at the French Crystal Palace, a plan of Sebastopol, a railway station, and the "Messiah" of Klopstock. Pliny, too, mentions the fact that Homer's Iliad, with its 15,000 verses, was written in so small a space as to be contained in a nutshell. The greatest

curiosity of all, however, was a copy of the Bible, written by one Peter Bales, a chancery clerk, in so small a book that it could be inclosed within the shell of an English walnut. A steam-engine which can be covered by an ordinary thimble has been constructed by an American watchmaker named Beck. Its height is only sixteen millimetres, and the space it occupies is less than three square centimetres. Its weight is one gramme. It has no fewer than 140 distinct pieces connected by means of 102 screws, yet the little machine works perfectly.

Polishing Wood-Work.

Soft woods may be turned so smooth as to require no other polish than that which can be given by holding fine shavings of the same wood against them in the lathe. For polishing mahogany, walnut and some other woods, the following formula is given: Dissolve beeswax by heat in spirits of turpentine until the mixture becomes viscid. Apply with a clean cloth, and rub thoroughly with another piece of cloth. Beeswax is sometimes alone used. For work in position, it must be melted and applied and rubbed as above. For work in the lathe, it can be applied by friction, the slight amount of wax melted being sufficient for the polish. The work should be thoroughly rubbed. Mahogany may be polished by rubbing first with linseed oil, and then by a cloth dipped in very fine brick dust. Some hard woods have a natural polish, and do not require a polishing medium. A fine gloss can be produced by rubbing with linseed oil, and then holding shavings or turnings of the same material against the work in the lathe. A very perfect surface can be obtained with glass paper, which, if followed by hard rubbing, will give a beautiful lustre. Lustre can also be given to carefully finished surfaces by applying a small quantity of thinned varnish, shellac or "fillers" by a cloth, and carefully and thoroughly rubbing.—*Comstock's "Interior and Interior Details."*

Practical Hints.

Electric Wire Covering.—M. Geoffroy, a wire manufacturer in Paris, has taken a patent for covering electric wires with asbestos. Experiments, which will be repeated officially, have proved that the copper can be burned without any spark being conducted outside.

Archimedes.—Archimedes said: "Give me whereon I may stand, and I will move the universe!" Ferguson, the celebrated astronomer, was accustomed to amuse himself by calculating that if, at that moment when Archimedes pronounced these words, God had taken him at his word, in furnishing him with a standpoint at the distance of 9,000 miles from the centre of the earth, with materials of sufficient strength, and a counterpoise of 200 lbs., this great geometrician would have required a lever of twelve quadrillions of miles—12,000,000,000,000,000—and a velocity at the extremity of the long arm equal to that of a cannon ball, to raise the earth one inch in 2,700,000,000 000 years.

Aluminium Silver.—Is made by melting together one part of silver with three or four of aluminium, and is very valuable for articles in which one of the main objects is to obtain lightness, such as the instruments used for marine observations. Octants and sextants of this alloy have been received with great favor by practical navigators. Those parts of such instruments which, if made with other metal, would weigh four pounds, will, when made of the above alloy, only weigh one pound. Mechanics like to work this alloy, as it can be turned and filed away, which is not the case with the pure aluminium which is too soft, and, as no doubt all know who have worked this interesting metal, it has the objectionable property of sticking to the file.

Absorbtion of Metal by Tin.—When an alloy of lead, tin, or other metal is made with sodium in a melting pot, great care must be used in subsequently freeing the melting pot of every trace of sodium before using it for melting tin in with a view of tinning copper or bronze articles, otherwise these articles when placed in the melted tin will be rapidly eaten away. This has been recently proved by accident, but it might have been expected from known facts concerning sodium alloys, which were long ago pointed out by Mr. Mallet, who showed, among other things, that if a strip of iron be coated with sodium amalgam and dipped into a pot of say molten tin, the iron will disappear faster than it can be put to the bottom of the pot.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business matter in letters or cards they are filed away and never reach the printer.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department. We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

Wanted engraver's tools with book of instructions, for a Victor Press, with cabinet, 2 type cases, type, ink roller and furniture complete; perfectly new. L. Warren, 72 Cumberland St., Brooklyn, N. Y.

A Fletcher Foot-Blower, cost $5, as good as new; will exchange for a Cushman, 2 in. or up scroll chuck, or other make; will give a satisfactory trade on the difference in price, if any. Louis Lutz, St. Clair Street, Toledo, O.

I have a lot of "Galaxy" (magazines) which I would like to exchange for an air rifle in good condition, a collection of birds' eggs, or offers. W. B. Greenleaf, 480 La Salle Ave., Chicago, Ill

I have a Mechanical Telegraph with book of instructions, books, etc., which I wish to exchange for good microscopical objects, mounted on 3 x 1 slips. Address, with list, J. H. Frey, Millersburg, Ohio.

To exchange, "How to Use Microscope," Wells' "Natural Philosophy," and many other books, chemical apparatus, etc., for good photographic camera, and lenses. W. H. Weed, 254 Putnam Ave., Brooklyn, N. Y.

Wanted "Quimby's New Bee Keeping," for "Our Own Birds of the United States," by W. S. Baily new. Joseph Anthony, Jr., Colota, Whiteside Co., Ill.

Wanted a good book in anatomy, in exchange for a book on chemistry, or for story books. A. G. G., Box 26, Summit, New Jersey.

A German-silver trimmed, patent lined, cocoa flute, cost $4, in good order, for good spy-glass, photo-material, or offers. Ewing McLean, Greencastle, Ind.

I have some fossil shells from the west bank of the Mississippi, to exchange for Indian relics. A. W. S., 187 E. 71st St., N. Y.

I have a magic lantern, Ruby pattern, nearly new, and 5 views; also "Our First Century," bound in leather, cost $7; state what is wanted in exchange. I. N. Spencer, Box. 217, So. Manchester, Conn.

First-class telegraph instrument and attachments, and "Wood's Botany," for bound volumes of periodicals, books, or offers. H. P. Albert, Anderson, Iowa.

Wanted a book on treatment and care of canary, also breeding of same; will give in exchange book named "Market Garden, Flower Garden and Bees," or 40 "Scientific Americans" or "Seaside Libraries;" want also old books. M. J. Mulvihill, Norwalk, Conn.

Coins, minerals, stamps, books, type, fishing tackle (very complete) and fish pole, bronze inkstand, etc., for coins, medals, stamps, war envelopes, old newspapers, and Continental, Colonial and Confederate currency. F. F. Fletcher, 103 Main St., St. Johnsburg, Vt.

Blow-pipe set (cost $10), large illustrated family Bible (cost $7.50), for Wood's Botany, Dana's Geology, or printing press and type. H. W. Noble, Box 134, South Dansville, N. Y.

Wanted, offers for fossil shells from the west coast of Africa. A. W. Seward, 187 E. 71st St.

I have a number of birds' eggs I should like to trade for other birds' eggs; send for list of trading eggs. A. G. G., Box 26, Summit, New Jersey.

For a microscope stand or offers, a 36-inch turning lathe (new) and a number of scientific books; send for list. A. Kendall, Somerville, Mass.

Wanted services of amateur printer with small office (or large), in exchange for an interest in a well-established weekly paper, good size. Eagle Office, Plymouth, N. H.

American Agriculturist microscope, new, cost $15, for amateur photographic apparatus, lever watch, 22 calibre breech-loading sporting rifle or magic lantern of equal value. Wm. A. Walker, Rockland, R. I.

I. T. Bell, Franklin, Pa., has back numbers of Scientific American, Forest and Stream, and Young Scientist, good flute, chessmen, books, etc., for good magic lantern, revolver, scarce coins, or offers.

A steel spring bracket-saw, 2 doz. saw blades, and about 1 doz. patterns for a good stylographic pen or offers; send postal before exchanging. Geo. Oakley, Rutherford, N. J.

A rosewood banjo, 11 inch head, 12 nuts, fully strung, together with lot of dime banjo music and instructions, for microscope, Webster's Unabridged, monkey, squirrel and cage, or offers. J. DeWitt Clark, P. O. Box 37, Brooklyn, N. Y.

For self-inking printing press and type, one Henry rifle, 16 shot, 44 cal., cost $40, in good order, or one double barrel shot gun, barrels London fine twist, or offers. J. B. Garrison, Belton, Bell Co., Texas.

What offers for "The Chefs D'Oeuvre D'Art, Paris Exhibition 1878," cost $16, good as new, bound; 1 large photo camera, complete, cost $95; Scientific American from 1859 to 1880, 4 vols. bound. D. Keesler, Stony Point, N. Y.

Sea shells of Atlantic coast, scientifically marked, for books, old or new magazines, Indian relics, natural history specimens, apparatus; anything. Wilfred Leon Miller, P. O. Box 392, Cape May, N. J.

A new 40 diameter microscope, corals, and minerals, for a stylographic pen, air gun, or offers. J. McBride, 54 Garley St., Chicago.

A dulcimer that cost $20, books and fossils, for a telescope, microscope, fossils, Indian relics, or offers. E. J. Votaw, Salem, Iowa.

A self-inking model press, 5 x 7½, cost $23; $90 worth of scroll-saw designs in lots to suit; Scientific American, 1880; Palliser's Useful Details, $3; for photo outfit or offers. C. H. Parker, Coldbrook Springs, Mass.

Telegraph key and sounder, Frank Leslie's Illustrated Magazines, mounted microscopic objects, natural curiosities, for bull's-eye condenser, photograph camera, Unabridged Webster Dictionary, or offers. W. T. Alan, Greenville, Mercer Co., Pa.

Large magic lantern, spectroscope, pantagraph, for enlarging drawings, rosewood writing desk, man's saddle, for microscope, photo outfit or offers. Thomas Walters, Bergen St., East of Brooklyn Ave., Brooklyn, N. Y.

Model card press, chase 3¼ x 5¼, with 4 fonts type, cases, etc., for good foot lathe. Mills Day, 2 Farmington Av., Hartford, Ct.

French microscope, inclines to any angle, delicate fine motion, neat upright case, cost $17.50, for scientific books; send list to W. Fitz, P.O. Box 2852, New York.

Wanted, Quinby's New Bee Keeping, for Our Own Birds of the United States, by W. S. Baily; new. Joseph Anthony, Jr., Coleta, Whiteside Co., Illinois.

Printing type, small pica; large and small capitals, and small letters; 60 to 65 lbs., including two large cases; also gothic nonpariel, for trade. J. Siler, 1242 Broadway, St. Louis, Mo.

One years' copy of Aldine, cost $5.50, and German accordion, with instructions how to use it, cost $5.00, for offers. Chas. Dempwolf, 86 Benson St., Paterson, N. J.

A Novelty printing press, with type, prints a form 5 x 7 inches, cost $40.00, for a microscope, photographic apparatus, or offers. T. W. Patterson, Warsaw, N. Y.

$80 worth of (nearly new) printing material, minerals, fossils, Aboriginal relics, etc., for scientific books, good American watch, and offers. F. M. Farrell, Cobden, Union Co., Ills.

Rocks, minerals, fossils and fresh water shells for microscope stand, $20 to $75, also for objectives, turning lathe type, and tools. D. D. Babcock, South Dansville, N. Y.

Magic lantern, in good order, condensing lens, 2½ in. diameter, 8 slides. For small photographic camera or offers. H. A. Giddings, 4 Union Place, Classon Ave., Brooklyn.

THE "ZERO" REFRIGERATOR.

One of the most valuable adjuncts to modern life is the refrigerator, preserving our food as fresh in the hottest months of summer as in the cold season. Among the various styles in the market the "Zero" has long been prominent by reason of the many excellent merits it possesses, among which may be mentioned beauty of design and excellent workmanship; the absence of all communication between the ice and provision chamber; the absence of moisture on the inside lining; the impossibility of the contact of hot air with the ice; the condensation of the moisture contained in the provision chamber on the cold surface of the ice-box, which, running off into a trough, is passed out at the bottom; the economy of ice and uniformity of temperature; and the filling of the refrigerator with cork and charcoal, which are good non-conductors, cleanly and odorless. These refrigerators are being used in many hotels, flats and private houses throughout the country, and seem to give general satisfaction. The manufacturer is A M. Lesley, of 380 Sixth Avenue, this city.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

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A Story of the Sea.

ON a brown rock off the seashore a beautiful sea anemone had planted herself. She was very delicate and lovely, and when fully opened resembled not a little the gorgeous flower called the night-blooming cereus, only that instead of yellow she was tinted with shades of the tenderest apricot color, almost approaching to pink. As the movement of the water swayed her transparent petals from side to side, she looked like some strange ethereal flower, and very exquisite.

So thought a humble black king-crab, who lay in a nook amongst the rocks on the sand beneath her. He could see her every morning as he went out for his breakfast, and longed that he might go up and speak to her.

"I wonder if she would think me very impertinent if I went and talked to her? I'll try anyway." And he marched along, with his heavy armor apparently weighing him down at every other step. Soon he raised himself, and, touching one of her petal-like arms very gently, said—

"Beautiful Actinia! may a humble shell-fish venture to address you?"

"Who are you?" said she (for sea-anemones have no eyes, though they can enjoy light, like other flowers).

"Only a king-crab." he answered, very meekly, for he felt so black, and hard, and ugly compared to her, that in his humility he almost doubted if she would notice him.

"Oh, indeed!" she replied. "Well, it is a comfort to have some one at any rate to speak to; for really, what with having to shut up on account of the low tide half one's time, and, when the water does cover me and I am fit to be seen, being deprived of all society, my time and beauty are entirely wasted, and I lead the life of a stone!"

"I am truly sorry to hear how dull you

are," said the crab. "Can I do anything for you?"

"Come and tell me all the news you can!" she answered, peevishly, for she thought, "Better this ungainly fellow than no one to admire me;" but she little knew what a true unselfish nature lived under the dark shell of the king-crab.

"This tide business is a dreadful trouble," she said, discontentedly. "I wonder what occasions it. I like being in deep water, where I can always be unfolded, because I know I am really worth looking at!"

"That you certainly are!" said the crab, with honest admiration; "but I think I can explain to you what occasions it, if it would amuse you to listen."

"You may as well tell me," the anemone answered, rather wearily. With this very poor encouragement the crab proceeded, for he loved her so much that in his heart he could find no fault with her, and thought all she did perfection.

"The earth is like a ball turning round always on a stick, or axis, passed through its centre: the moon travels round the earth, and the two together make what is called a system."

"That is very stale news," laughed the anemone. "I know what you are going to say—that the moon attracts the water!"

"On the contrary," quickly responded the crab, "that is a well-known mistake amounting almost to a superstition of bygone ages, and I will show you how that idea originated. As the earth is larger and heavier than the moon, one would weigh heavier than the other. If I could put them in miniature each at opposite ends of a stick, and if I tried to balance them on my claw, we should find that, owing to the earth's greater weight, I should have to put my claw, not in the middle of the stick, but closer to the earth than to the moon. This would be the balancing point, and the centre of the system of the earth, and the moon, round which they revolve, is always in a line with each."

Here the anemone seemed a little more interested, for she unfolded every tiniest petal as if to catch every word. Encouraged by this, the king-crab continued—

"As the earth turns separately from the moon it brings its great seas and oceans every now and again opposite this centre of the system, and the moon also, they being in the same line. The waters rise and expand to this centre (but not to the moon) as they pass over them, so making a tide till they are past; and when the centre and the moon have reached the opposite side of the earth, the same sea, not having forgotten its motion, tries to rise again, and this forms a second tide. So this is why there are two tides in the twenty-four hours—a real, and what we may call a false, tide."

"Then the moon has really nothing to do with it beyond being in a line with the centre of attraction?" remarked Actinia, gracefully waving her pink arms.

"None whatever," answered the crab; "but as no one can see the centre point, and the moon can be seen, it makes people say the tides are caused by the attraction of the moon—a power that I, for one, believe she does not possess."

Just then a handsome spotted dog-fish swam past, gently touching one of the anemone's arms in recognition.

"Ah! is that you?" she said, "I thought myself quite forgotten by my old friends."

"That would be impossible, fair Actinia," said the dog-fish, with the easy grace of a refined and thoroughbred manner, for his family being a very old one were looked up to as extremely aristocratic. "My mother and sisters are spending such a pleasant time among the rocks of the great seaweed forest that stretches westward to the Bahama Islands, and are wishing so much to see you, that I came over to try and persuade you to drift over there next time the undercurrent sets in that direction."

"How very kind of you!" said the delighted anemone. "I hope it will come soon, for I am dying to get out of this dull place."

The king-crab hearing this felt a little disappointed to find that he must have succeeded so badly in amusing her, and could not help wishing also that he was

as handsome and attractive as the dog-fish, for whom the anemone showed so decided a preference, and of whose charms, after his visits, she was never tired of talking. However, he continued to do his best for her, finding it such a pleasure to minister to her in any way, for he loved her so dearly.

At last one morning, when he came to the accustomed rock to bid her "good morning," he was startled to find she was gone. Slowly and sadly he was turning away when a friend—a merry old porpoise—came swinging along past him.

"Your pretty lady-love has deserted you, I fear," he grunted out.

"Have you seen her?" eagerly asked the crab.

"Oh yes! more than two miles from here, floating away lightly with the westward current, and milord dog-fish in close attendance. I wonder you aren't jealous." And the porpoise whisked and flapped his tail about.

"Ah, no!" answered the king-crab, "jealousy is such a vulgar thing, and but another word for selfishness. If you really love anyone very much you would enjoy to know they were happy before all things; their happiness would be your first object, obtained at no matter what sacrifice to yourself. I know she is happy, and though I miss her sadly, and should dearly like to have given her the pleasure, I am very glad the dog-fish—who is a right good fellow—has taken her where she so longed to go, and I hope he and his friends will be very good to her and take great care of her."

"Ah well," said the porpoise, rolling about, "that may be all very well, but I always thought she treated you very badly, and I can't make you out!" which, of course, he couldn't, seeing that the porpoise was like the generality of the world, by whom real love with its unselfishness is rarely understood!

—Carbolic acid, diluted with ten parts of water and thrown into the cracks and crevices where ants or cockroaches abound, will invariably drive them away.

Hyacinth Culture.

DOUBTLESS many of our readers are fond of flowers, and would like to get some information regarding their management and culture. The hyacinth is a beautiful flower and a great favorite with many whose attempt to raise it has frequently ended in failure. To be successful in rearing this plant, procure a number of hyacinth glasses—say from six to twenty—fill them all with water at the same time. Fresh rain-water is to be preferred, and the glasses should be so filled that the water only just touches the base of the bulb. Rain water should not be employed unless it is quite fresh, or otherwise it soon becomes putrid, and causes the roots of the bulbs to decay. If there is no alternative but to employ hard water, let it be exposed to the action of the sun or external air for a while before being poured into the glasses.

Hard water used immediately after it is drawn from the well is apt to cause the roots to become a mass of pulp, highly offensive, and fatal in its effects. Two or three pieces of charcoal should be placed in the glasses a few days before they are occupied by the bulbs, in order to allow of the charcoal becoming saturated and sinking to the bottom, which will keep the water from turning rank, and remove the necessity of its being often changed. By taking this precaution, flowers may be raised and matured without changing the water.

Place the glasses in a dark and rather cool situation until the roots have nearly reached the bottom of the glasses, when they can be brought out to the light. A month or six weeks' confinement is quite sufficient to bring the roots to the proper state of development, so that the glasses may be removed to the light. The glasses should be placed in the most airy and lighted part of the room, and as far from the fire as possible, but where there will be no danger of frost ever reaching.

When the bulbs have been in the water a week or ten days, they should be examined, and if any decaying roots or slimy matter be found upon them, the substance should be removed at once. As the shoot or growth increases in size,

evaporation will take place; therefore, the water should be replenished at intervals, care being taken that what is supplied is not lower in temperature than that in the glass. The foliage of the plant should be kept scrupulously free from dust or dirt; a small piece of sponge being used for this purpose will do the work nicely and without injury to the plant if care be taken in the handling. When the flower spikes begin to show themselves the glasses should be kept filled with water to the brim, as at the point of flowering the bulbs absorb a great deal of moisture. The reader need hardly be reminded that when the glasses are once brought into the lighted room, the temperature of the room should be kept as even as possible.

Bulbs may be put down during the early part of November, but it is better to get them down in October when convenient. Fine plants, however, have been raised when the bulbs have been placed as late as December.

We should like very much to hear from some of our readers who have had experience in the culture of hyacinths, as we are sure the subject is one that will be interesting to most of our subscribers.

An Autumn Leaf Lamp Shade.

THE design for a lamp shade, Fig. 1, consists of a central group of either maple or oak leaves that have been thoroughly dried and pressed. The fine line border is composed of small wood ferns and parts of ferns, and smilax. The body of the frame consists of heavy but finely perforated cardboard. The dried autumn leaves and ferns are fastened to the cardboard by applying a thin coating of well cooked and thick starch to the backs of the leaves, in as small a quantity as possible, so as to avoid all spreading of the starch beyond the margins of the leaves, and the consequent disfigurement of the cardboard. After the leaves are in position, the cardboard is placed between the leaves of a book on which weights are placed to obtain extra pressure. When the leaves have become thoroughly pressed and dried, a thin coat of furniture or other varnish is applied to both sides of the board. A frame, consisting of wire of the thickness of that used on hay, is shaped as shown at Fig. 2. The ends of the wire are brought together at B, and are bound with fine wire. That part of the wire which forms a circle

Fig. 1.

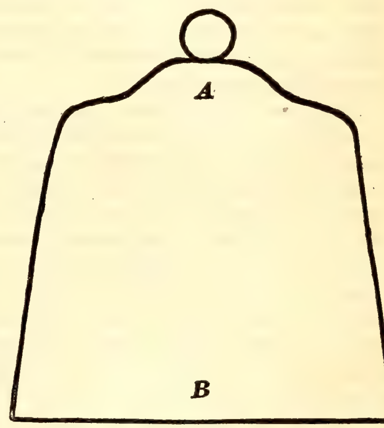

Fig. 2.

LAMP SHADE.

at A, is not bound together, but is left free, so that it can be expanded to the size of any ordinary lamp chimney. To the bottom, and half way up the sides of the wire frame, the edges of the cardboard are sewed, after which the cardboard is bound with green ribbon. The lamp-light effect of such a shade is very pleasing and soft.

How to Join a Lead Pipe.

BY AN AMATEUR.

AN amateur who can do one thing thoroughly well, and who understands the reasons for each step in the process, will easily extend his knowledge and skill to analogous cases. Now, there is scarcely a more useful handicraft in the home, especially in frosty winters, than plumbing; and the amateur who possesses even moderate knowledge of the craft will save his household a vast amount of inconvenience, and himself no small expense. The object of this paper is to describe the method of making a joint in a lead pipe running down the angle of a room, or in any similar position in which there is no side strain. Such a pipe is often split open by the frost, and it becomes necessary to cut away the damaged piece, and to replace it by a new length, involving the making of two joints, one at each end of the new piece.

In making such a joint, there are three distinct stages in the process:—

1. Shaping the ends of the pipe.
2. Putting in the solder.
3. Making the joint.

Where the amateur has most likely gone wrong has been in not attending to the distinction between 2 and 3, or perhaps in ignoring 3 altogether. The consequence is his joints leak, or even come apart without effort.

1. *Shaping the Pipe.*—The two ends to be joined should be cut off square with a small-toothed hand-saw. Then the open end of the lower pipe is to be spread out funnel-wise, by driving into it a cone of box wood made for the purpose. It is something like an elongated peg-top, and may be had for a few cents at a tool-shop. A few blows on the top of it, when placed in the open pipe, will soon produce the funnel shape. The end of the upper pipe must now be rasped all round, so as to fit easily into the funnel opening of the lower pipe. This rasping will reduce the thickness of the pipe at its opening to perhaps one-sixteenth of an inch, but care must be taken not in any way to crush up the pipe, so as to choke the waterway through it, or stoppages may occur when it is in use.

The end of the upper pipe now drops easily into the funnel of the lower one, so as to leave a narrow channel all round the top of the funnel outside the upper pipe.

2. *Putting in the Solder.*—The tools and appliances for plumbing and soldering are very few and simple. The chief agent is heat, and the chief operation applying that heat under the proper conditions for it to do its work in uniting the pieces of metal. Now, for the solder to take to the lead, it is essential that the parts of the lead pipe to be united should be perfectly bright and clean. If they are at all oxidized or dulled, as lead always becomes after exposure to the air, the solder will not take. With a pocket-knife scrape the inside of the funnel-shaped pipe-end perfectly bright; if the lead pipe is old, there will be seams of corrosion in it that must be carefully cut or scraped out, otherwise the joint may leak. Take care not to drop the chips of lead down the pipe, or they may cause trouble elsewhere. Then the outside of the rasped end must also be scraped perfectly bright, unless the rasping has done this sufficiently. The proper tool for this scraping is a "shave-hook," a triangular piece of steel at the end of a short handle, but a pocket-knife will answer every purpose. The bright surfaces soon get dull on exposure to the air, but as the joint is going to be made at once, there is no need to protect the scraped lead in waiting.

When the metal is highly heated, the action of the oxygen of the air upon it is much more rapid, and as, in making the joint, the solder itself is melted, and the lead surfaces nearly so, it becomes necessary to protect the bright surfaces with what is called a "flux," to keep the air off them when they are raised to the high

temperature required in the operation, and thus to prevent the rapid oxidation, which would frustrate the soldering. The flux usually employed for such joints as this is powdered resin, but tallow is also used.

The funnel and pipe end being scraped perfectly bright, and dropped into each other in position, sprinkle some powdered resin into the channel formed by the upper part of the funnel and the pipe that fits into it. Then put the melted solder into this channel all round. This may be done in two ways—melt the solder in a small iron ladle and pour it into the joint, or heat the copper soldering-bit, and holding a stick of solder against it, drop the solder as it melts into the joint, taking care that there is enough solder all round. The soldering-bit is a pointed piece of copper, fitted into an iron shank with a wooden handle. Some prefer the copper end at right angles to the handle, but the bit is usually made all in the same line. The bulkier the copper, within reasonable limits, the more heat it will hold.

3. *Making the Joint.*—The joint is in position, and the solder is run into it, but the joint is not yet "made." As the solder drops into the channel, it will be immediately chilled by the cold lead on both sides, and at this stage it is only like being run into a mould. There would be no amalgamation between the solder and the surfaces it is intended to unite, and it would be quite easy to pull the joint asunder while in this condition. Enough heat must be brought to bear on the joint to melt the solder, and to raise the adjoining lead surfaces to such a temperature that they shall amalgamate with the solder, and form one continuous mass of metal. The solder used with any particular metal is always such as to melt at a rather lower temperature than the metal itself, so that the solder be melted into the joint without melting the sides of the joint.

Heat the soldering-bit hot enough to melt the solder easily; then put the pointed end of it downwards into the solder that has been run into the joint, and melt it thoroughly. Carry the point of the bit in this way slowly all round the joint, thoroughly melting the solder at every point. When this has been effectually done the joint is "made." The heated bit has melted the solder, and at the same time raised the bright surfaces of lead on both sides to such a temperature that they have amalgamated with the solder, and the joint is one solid piece of continuous metal throughout. At the same time, the resin melting has kept the air from the joint and prevented oxidation.

The amateur will now let the water into his pipe, and watch with anxiety whether there is any of that exudation which tells him that his work is not perfect. If he sees those tiresome water-beads begin to stand about his joint, he had better let the water off, and when the pipe and joint are thoroughly dry, paint the joint well with any ordinary wood-paint: this will make it water-tight. But with moderate pains, and careful attention to the reasons of the thing, he will soon find himself able to make reliable joints, and will be, so far, independent of the plumber. It is an excellent plan to get a piece of lead pipe and practice making joints, cutting them open with the saw to see how the work has been done.

Marvels of Pond Life.—XIII.

In the latter part of October I observed some fragments of a new creature among some bits of Anacharis, from the Vale of Heath Pond, and searched for complete and intelligible specimens without effect. Luckily one evening a scientific neighbor to whom I had given some of the plant for the sake of the beautiful *Stephanoceri* which inhabited it, came in with a glass trough containing a little branch, to which adhered a dirty parchment-like ramifying tube, dotted here and there with brown oval masses, and having sundry open extremities, from which some polyp-shaped animals put forth long pearly tentacles margined with vibrating cilia, and making a lively current. The creatures presented an organization higher than that of polyps, for there was an evident *differentiation* and complication of parts. They belonged to the *Polyzoa* or *Bryozoa*,* a very impor-

* *Polyzoa* means "many animals," in allusion to their habit of living in association. *Bryozoa*, "moss-animals," from some forming cells having that appearance.

tant division of the *mollusca*. The *Polyzoa* are chiefly marine, and the common "sea-mat," often erroneously treated as a *sea-weed*, is a well-known form. A species of another order often picked up on our coasts is the *Sertularia*, or Sea-Fir, composed of delicate branching stems of a horny-looking substance, which, under a pocket lens, is found to contain an immense number of small cells inhabited by Polyps. It is instructive to compare the two and note how much more advanced in structure is the Polyzoon than the Polyp.

Polyzoa were formerly associated with the Polyps, to which they bear a strong superficial resemblance; but they are of a much higher degree of organization, as will be seen by comparing what has been said in a former article on the *Hydra*, with the description which we now proceed to abridge from Dr. Allman's splendid monogragh on the fresh-water kinds. In order to get a general conception of a Polyzoon, the Professor tells us to imagine an alimentary canal, consisting of œsophagus, stomach, and intestine, to be furnished at its origin with long ciliated tentacles, and to have a single nervous ganglion on one side of the œsophagus. We must then conceive the intestine bent back till its anal orifice comes near the mouth; and this curved digestive tube to be suspended in a bag containing fluid, and having two openings, one for the mouth and the other for the vent. A system of muscles enables the alimentary tube to be retracted or protruded, the former process pulling the bag in, and the latter letting it out. The mouth of the bag is, so to speak, tied round the creature's neck just below the tentacles, which are the only portions of it that are left free. The investing sack has in nearly every case the power of secreting an external sheath, more or less solid, and which branches, forming numerous cells, in which the members of the family live in a socialistic community, having, as it were, two lives, one individual, and the other shared in common with the rest.

The whole group of tubes and cells, whatever may be the form in which they are aggregated, is called the *Polypary*, or, as Dr. Allman prefers, the *Cœnœcium* (common house); the creature he names a *Polypide** (polyp-like); and the disk which bears the tentacles (*Lophophore* (crest-bearer). There are some more hard words to be learnt before the student can enjoy himself scientifically among the Polyzoa, and we shall be compelled to employ some of them before we have done; but we will now endeavor to describe what was presented to our view by the specimen obtained from the Hampstead Pond, which was a branch of *Plumatella repens*.

When all was quiet, the mouths of the bags belonging to each cell were slowly everted, and out came a numerous bundle of tentacles, which were either spread like the corolla of a flower, or permitted to hang dishevelled like the snake-locks of Medusa. We will suppose these organs symmetrically expanded, and that we are looking down upon them with a magnifying power of sixty diameters, the light having been carefully adjusted by turning the reflecting mirror a little on one side, to avoid a direct glare. The tentacles, each of which curves with a living grace, and displays an opaline tint in its glassy structure, do not form a complete circle, for at one place we discern two slightly diverging arms of the disk, or frame (Lophophore) from which they grow.

These arms support tentacles on each side, and leave a gap between, so that the whole pattern is *crescentic*, or crescent-shaped, and not circular. Extending as far as the points of the arms, and carried all round the crescent, is an extremely delicate membrane, like the finest gauze, which unites all the tentacles by their basal portions, and makes an elegant retreating curve between every two. Each tentacle exhibits two rows of cilia, which scintillate as their vibrations cause them to catch the light. The motion of the cilia is invariably *down* one side and *up* the other, the current or pattern being carried on from one tentacle to the other, all through the series. This characteristic, and the facility with which each cilium can be distinguished, gives great interest and beauty to the spectacle of this wonderful apparatus, by which water-currents are made to bathe the tentacles and assist respiration, and also to carry food towards the mouth, over which a sort of finger or tongue is stretched to guard the way, and exercise some choice as to what particles shall be permitted to pass on. This organ is called the *epistome*, from two Greek words, signifying "upon the mouth."

If the cell is an old one, it may be covered with so much extraneous matter as to obscure the economy within; but we are fortunate in having a transparent specimen before us, through which we can see all that goes on. The alimentary tube, after forming a capacious cavity, much longer than it is broad, turns round and terminates in an orifice near the mouth, and just below the integuments. When refuse has to be discharged, this orifice is protruded; and after the operation is over, it draws back as before. Long muscles, composed of separate threads or

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* *Polyzoon* is preferable, as avoiding confusion with *polypite*, used for another class of objects.

fibres, pull the creature in and out of its cell, and at the part where the stomach ends, and the intestine turns round, is attached a long flexible rope, called the *funiculus*, which goes to the bottom of the cell. The passage of the food down to the stomach, its digestion, and the eviction of the residue, can all be watched; and when a large morsel is swallowed, the spectacle is curious in the extreme.

One day a polyzoon caught a large rotifer, (*R. vulgaris*,) which, with several others of its tribe, had been walking over the *cœnœcium*, and swimming amongst the tentacles, as if unconscious of danger. All of a sudden it went down the whirlpool leading to the mouth, was rolled up by a process that could not be traced, and without an instant's loss of time, was seen shooting down in rapid descent to the gulf below, where it looked a potato-shaped mass, utterly destitute of its characteristic living form. Having been made into a bolus, the unhappy rotifer, who never gave the faintest sign of vitality, was tossed up and down from the top to the bottom of the stomach, just as a billiard-ball might be thrown from the top to the bottom of a stocking. This process went on for hours, the ball gradually diminishing in size, until at last it was lost in the general brown mass with which the stomach was filled. The bottom of the stomach seems well supplied with muscular fibres, to cause the constrictions by which this work is chiefly performed, and by keeping a colony for a month or two, I had many opportunities of seeing my Polyzoa at their meals.

When alarmed the tentacles were quickly retracted, but although these creatures are said to dislike the light, and usually keep away from it in their native haunts, my specimens had no objection to come out in a strong illumination, and seemed perfectly at their ease. They were indeed most amiable creatures, and never failed to display their charms to admiring visitors, who rewarded them with unmeasured praise. Twice I had an opportunity of observing an action I cannot explain, except by supposing either that the tentacles of *Plumatella* have some poisonous action, or that rotifers are susceptible of fear. On these occasions the common rotifer was the subject of the experiment. First one and then another got among the tentacles, and on escaping seemed very poorly. One fellow was, to borrow a phrase from Professor Thomas Sayers, "completely doubled up," and two or three seconds—long periods in a rotifer's life—elapsed before he came to himself again.

By keeping a colony of the Plumatella for a wew weeks in a glass trough, and occasionally supplying them with fresh water from an aquarium, containing the animalcules, they are easily preserved in good health, and as they develop fresh cells, the process of growth may be readily watched. This production of fresh individuals enlarges the parent colony, but could not be the means of founding a new one, which is accomplished by two other modes. A little way down the cells Professor Allman discovered an ovary attached to the internal tube by a short *peduncle*, or foot stalk, while a testis or male generative organ is attached to the *funiculus*, or "little rope," we have already described.

July and August are the best times for observing the ovaries, and they are most conspicuous in the genera *Alcyonella* and *Paludicella*. True eggs are developed in the ovaries in a manner resembling this mode of multiplication in other animals; but there is another kind of egg, or, perhaps to speak more properly, a variety of bud, which is extremely curious. In looking at our specimens we noticed brown oval bodies in the cells. The centre is dark covered with a net-work, which is more conspicuous in the lighter colored and more transparent margins. These curious bodies are produced from the funiculus, and act as reserves of propagative force, as they are not hatched or developed until they get out and find themselves exposed to appropriate circumstances. Professor Allman names them *Statoblasts*, or stationary germs, and they bear some resemblance to what are called the "winter eggs" of some other creatures. The Professor was never able to discover any mode by which they were permitted to escape from the cells, and in our colonies none were allowed to leave their homes until the death of their parent, and the decomposition of its cell had taken place; a process which went on contemporaneously with the growth of new cells, until the plant on which the *cœnœcium* was situated, rotted away, and then unfortunately the whole concern went to pieces.

The tubes of the *Plumatella*, and of most other Polyzoa, are composed of two coats, called respectively *endocyst* and *ectocyst*, that is, "inner case" and "outer case." The first is vitally endowed, and exhibits vessels and muscular fibres. The second or outer case is thrown off by the first. It is a parchment-like substance, strengthened by the adhesion of dirt particles, and does not appear to exercise any vital functions, but to be merely a covering for protection. The inner layer terminates in the neck of the bag before described, as exserted when the polypide comes out, and inverted when it goes in. This mode of making a case or sheath by inversion of a bag is technically called *invagination*, and is readily seen in new and transparent cells.

The movement of *eversion*, or coming

out, is chiefly produced by the contraction of the endocyst; while the *inversion*, or getting in again, is performed by the long muscles, which, when the animal is extended, are seen attached to it like ropes. Upon these muscles Professor Allman remarks that they are "especially interesting in a physiological point of view, as they seem to present us with an example of true muscular tissue, reduced to its simplest and essential form. A muscle may here be viewed as a beautiful dissection far surpassing the most refined preparation of the dissecting needle, for it is composed of a bundle of elementary fibres, totally separate from one another through their entire course." He further adds, "The fibres of the great retractor muscle are distinctly marked by transverse striæ—a condition, however, which is not at all times equally perceptible, and some of our best observers have denied to the Polyzoon the existence of striated fibre."

We can confirm the fact of this sort of fibre being present, but we fancy a reader not versed in the mysteries of physiology exclaiming, 'What does it matter whether his fibres are striped or not?'

Physiologists used to suppose there was a strong and marked distinction and separation between *striped* muscles, that is, muscles the fibres of which exhibit transverse stripes when magnified, and those which do not. Kolliker, however, says this decided separation can no longer be maintained,* and he gives instances in proof of the connections that can be traced between the two forms. In the higher animals the striped muscles are the special instruments of *will*, and of movements that follow, or are accompanied by, distinct sensations. Striped fibre must be regarded as the highest form; and as a muscle of this sort contracts in length it increases uniformly in breadth.

There are many other genera and species of fresh-water polyzoa besides the *Plumatella repens*, and they are found attached to sticks, stones, or leaves, generally to the under surface of the latter. They are all objects of great interest and beauty, which, whatever their diversity, conform sufficiently to one type that the student who has observed one, will easily recognize the zoological position of another. They should be viewed by transmitted and br dark-ground illumination, which produces very beautiful effects. To observe them in the performance of their functions, they require more room than the live-box can afford, but are well shown in the glass trough, whose movable diaphragm enables them to be brought near enough to the object-glass, for the use of a power of about sixty linear for general purposes, and of from one to two hundred for the examination of particular parts. For a more detailed examination dissection must be employed, but all that we have mentioned can be seen without injury to the living animal, if specimens are kept till new cells are formed in water, which does not contain enough dirt to render their integuments opaque.

* 'Manual of Human Microscopic Anatomy, p. 63.

Scientific Absurdities.

WHEN scientific writers depend upon their imagination for their facts, they are apt to make rather wild work. There are very few men who can follow closely, step by step, the scientific *necessities* of any supposed combination, and hence when a supposed scientific discovery is described without having been actually put to the test, the writer is very apt to overlook some essential point. A writer in *Les Mondes*, under the heading, "Hunting by Electricity," thus describes an experiment, which, as any tyro ought to know, will not work: "A new application of the Ruhmkorff coil has been made in the neighborhood of Marseilles. Instead of using bird-lime on trees which are frequented by birds of passage, a copper wire is wound around the trunk and a decoy attached to a neighboring staff. When a numerous flock has been attracted by the decoy, a shock is sent by the commutator, and they are more surely stunned than by a rifle."

That the bird may be killed, or even stunned, it is necessary that the shock be passed through it, and to do this it must be placed between the poles. A good conductor connecting these poles, may be safely held in the hand, no matter how powerful the discharge may be. We should be very much surprised to learn that the birds in the neighboring wood of Marseilles are in the habit of deliberately sitting down between the poles of a Ruhmkorff coil, so as to be killed, even though there is a handsome decoy attached to a neighboring staff.

The same writer also tells us that "experiments of a similar kind have also been made by M. Dalmas upon the vines at his country-seat, and powerful shocks are said to have destroyed the parasites to-

gether with their eggs. If this statement is confirmed, the ingenious inventor may reasonably expect the prize of 100,000 francs, which has been offered for the destruction of the phylloxera."

It strikes us that this is a good deal like the Dutchman's powder for killing fleas, the method of using which was, first to catch the flea and then put the powder in its mouth.

Planting for Timber and Fuel.

The attention of our people in the older States is being properly turned to planting rocky ridges and worn-out pastures with forest trees. This work is done by those having no expectation of cutting timber themselves, but with a view to improve their property for future sale or for their heirs. These old pastures are now worth $10 or less per acre. Forty or fifty years hence, covered with heavy timber, they would be worth $300 or more per acre. Two elements may safely enter into this calculation of the profit of tree planting: the steady growth of the trees, and the constant increase in the price of fuel and timber. There is great difference in the price of the varieties of wood, but still more in the rapidity of their growth. Hickory grows more rapidly than white-oak, and in most markets is worth a quarter more for fuel. Chestnut grows about three times as fast as white-oak, and for many purposes makes quite as good timber. It is in great demand by the ship-builders and cabinet-makers. The chestnut, the tulip tree, and the hickory attain a good size for timber in twenty or twenty-five years, and the spruce and pine want about fifty years. The maples grow quite rapidly, and are highly prized, both for fuel and for cabinet purposes. On light sandy soil, the white pine will grow rapidly, and cannot fail to be a good investment for the next generation. As a rule, the more rapid growing trees, if the wood is valuable, will pay better than the oaks.

Glycerine as an Anti-Freezing Agent.

The growing use of hydraulic machinery for riveting, flanging, etc., in our iron works, and for elevators, hoisting machinery, cranes, etc., makes the question of avoiding the danger incident to the freezing of water in the pipes an important one. The *Engineer* states that in England there is no generally adopted method. An admixture of alcohol, salt or glycerine has been tried, and Mr. Tweddell, well known in connection with hydraulic machinery, made some experiments on the effect of the addition of glycerine. In open vessels, at a temperature of 28°, when pure water froze rapidly, only a lump of rotten ice was formed when 1 per cent. of glycerine was present, less still with 2 per cent., the ice formed not being sufficiently solid to flow, especially with a pressure of 1,500 lbs. per square inch. One firm found that in adding one gallon of glycerine to 300 gallons of water no trouble whatever was experienced, while another firm uses 25 per cent., although they believe 10 per cent. to be enough for ordinary purposes. Salt is much cheaper, but while glycerine rather preserves leather packings than otherwise, common salt destroys them, especially when in cast iron. Glycerine has also been used with good effect in gas-meters.

Deterioration in Thermometers and Hydrometers.

M. Saleran, in *Comptes Rendus*, calls attention to defects liable to be produced in thermometers and hydrometers if used for certain purposes. Changes in thermometers ranging as high as 8° to 10° C. occur at printing-ink works, where oils are heated for several days to 670°, in glycerine works, and with rectifiers of benzol. Glass is not only modified when heated to 300°, but it undergoes true deformation at far lower temperatures. Thus, the hydrometers used in sugar works, which are often exposed for a considerable time to temperatures of 95° are affected. After an immersion of some days they are completely modified, their weight decreases and they become erroneous to the extent of 7° to 8° B. The London *Chemical News* adds that in many chemical works it has been found necessary to submit all hydrometers used for hot liquids to a weekly comparison with a standard instrument.

Hardening and Testing.

To *really test* the hardness of the surface of metal, we must take a *new*, or at least a good, *dead smooth* file and apply one corner of it to a corner rather than on a flat surface of the metal to be tested, pressing the file very firmly against the work. A coarse file, even if a new one, is useless to test with. The greatest degree of hardness is obtained by plunging the red-hot steel into mercury. Steel hardened from the surface inward is hardest on the surface, while in steel that has been tempered the exterior is the softest. In the one case because the surface was cooled in advance, in the other because it was heated in advance. Files are hardened in the following mixture: 2 parts (by weight) of

salt, 15 parts of rye meal, and 30 parts of burnt cow hoofs, all ground together and mixed with a sufficient quantity of water to make a pasty mass, with which the files are covered. When dry, they are placed in a fire. If, during the heating, the coating should drop off at certain places, the files are promptly withdrawn and the place exposed is covered with dry hoof powder. It is returned to the fire, where it is left until a temperature is reached which best suits the steel of which it is made. Then the file is plunged vertically into the bath, care being taken not to move them to the right or left, as that would cause warping. The bath is made in the following manner: 28 parts of salt are dissolved in about 5 parts of water, to which a handful of iron scale is added. The tangs are softened by being plunged into red-hot lead.

A Puzzle for Young Latin Pupils.

A few years ago Dr. H. D. Paine, of this city, sent the following card to the members of the New York Medical Club:

"SCIENS, SOCIALITE, SOBRIETE."

Doctores—Ducum nex mundi nitu Panes; tritucum at ait. Expecto meta fumen tu te & eta beta pi. Super atento, uno. Dux, hamor clam pati, sum parates, homine, ices, jam, etc. Sideror hoc. Anser.

"FESTO RESONAN FLOAS SOLE."

Our young readers will find some amusement in the endeavor to translate the above.

Practical Hints.

Wild Cherry Wood.—The wild cherry, *Cerasus serotina*, is said by Robert Douglas, of Illinois, to be one of the most rapid growers of all our valuable Northern hard-wood forest trees, making lumber almost equal in value to the black walnut. It grows freely on any dry land, even if too poor for agricultural purposes. It is healthy everywhere, of upright growth, and is very easily transplanted.

To Kill Knots before painting, make a mixture of glue size and red lead; or shellac dissolved in alcohol and mixed with red lead; or gutta percha dissolved in ether, will. either of them, make a good coating for knots, but will not stand the sunshine, which will draw the pitch through the paint. The best method is to cover the knot with oil size and lay a leaf of silver over it.

Sharks.—The skins of certain sharks are used in jewelry for sleeve buttons and the like, and when dried and cured take a polish almost equal to that of stone, and greatly resemble the fossil coral *porites*. The vertebræ of the shark are always in demand for canes. The opening filled with marrow during life is now fitted with a steel or iron rod. The side openings are filled with mother-of-pearl, and when polished the cane is very ornamental.

Removing Stains of Nitrate of Silver.—Cyanide of potassium is the substance generally used, but its employment is fraught with danger, as it may be absorbed through abrasions of the skin. A much safer way, and equally expeditious, is to soak the stains, whether on the hands or on dresses, with a strong fresh solution of iodine, and after a few minutes to treat them with a concentrated solution of sodium hyposulphite. The iodine converts the silver into iodide, which is afterwards dissolved off by the hyposulphite.

Poisonous Wall-Papers.—The full extent of the peril attending the use of arsenical wall-papers is not yet, it would seem, realized. It is startling to find that surprise has been excited by the statement that not only green but other brightly-colored papers contain arsenic. As a matter of fact, we believe that mineral substances form an integral part of many coloring matters extensively employed, and, while needless or at least avoidable, their presence is to be suspected in most papers which have not been prepared with a special view to health; hence the need of unusual precautions.—*London Lancet.*

A Large Monolith.—At a granite quarry in Westerly, Rhode Island, there was recently detached a monolith 150 feet long, 10 feet wide, and 8 feet thick, weighing over 1,000 tons. These dimensions greatly exceed those of the Obelisk of Semiramis, the largest of the Egyptian monoliths. The stone was loosened by one oblong blast-hole in such a simple and perfect manner that the theories and conjectures advanced by many as to the methods of the Egyptians appear absurd. It contains over 12,000 cubic feet of granite which, cut into smaller blocks, will fetch about $30,000. Mr. French, the engineer in charge, is quite positive that it could be taken to New York City, finished as an obelisk, and erected for about $150,000.

How to Keep Bouquets—There are various receipts for keeping bouquets fresh. Some people stick them in moist sand; some salt the water in the vases, and others warm it; others, again, use a few drops of ammonia. My rule is, to cool the flowers thoroughly at night. When the long day of furnace heat has made the roses droop aad their stems limp and lifeless, I clip them a little, and set them to float in a marble basin full of very cold water. In the morning they come out made over into crisp beauty, as fresh and blooming as if just gathered. All flowers, however, will not stand this water-cure. Heliotrope blackens and falls to pieces under it; azaleas drop from their stems; and mignonette soaks away its fragrance. For these I use dry cold air. I wrap them in cotton wool, and set them on a shelf in the ice-chest. I can almost hear you laugh, but really I am not joking. Flowers thus treated keep perfectly for a week with me, and often longer.—*St. Nicholas.*

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business matter in letters or cards they are filed away and never reach the printer.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

Wanted engraver's tools with book of instructions, for a Victor Press, with cabinet, 2 type cases, type, ink roller and furniture complete; perfectly new. L. Warren, 72 Cumberland St., Brooklyn, N. Y.

A Fletcher Foot-Blower, cost $5, as good as new; will exchange for a Cushman, 2 in. or up scroll chuck, or other make; will give a satisfactory trade on the difference in price, if any. Louis Lutz, St. Clair Street, Toledo, O.

I have a lot of "Galaxy" (magazines) which I would like to exchange for an air rifle in good condition, a collection of birds' eggs, or offers. W. B. Greenleaf, 480 La Salle Ave., Chicago, Ill.

I have a Mechanical Telegraph with book of instructions, books, etc., which I wish to exchange for good microscopical objects, mounted on 3 x 1 slips. Address, with list, J. H. Frey, Millersburg, Ohio.

To exchange, "How to Use Microscope," Wells' "Natural Philosophy," and many other books, chemical apparatus, etc., for good photographic camera, and lenses. W. H. Weed, 254 Putnam Ave., Brooklyn, N. Y.

Wanted "Quimby's New Bee Keeping," for "Our Own Birds of the United States," by W. S. Baily; new. Joseph Anthony, Jr., Colota, Whiteside Co., Ill.

Wanted a good book in anatomy, in exchange for a book on chemistry, or for story books. A. G. G., Box 26, Summit, New Jersey.

A German-silver trimmed, patent lined, cocoa flute, cost $4, in good order, for good spy-glass, photo-material, or offers. Ewing McLean, Greencastle, Ind.

I have some fossil shells from the west bank of the Mississippi, to exchange for Indian relics. A. W. S., 187 E. 71st St., N. Y.

I have a magic lantern, Ruby pattern, nearly new, and 5 views; also "Our First Century," bound in leather, cost $7; state what is wanted in exchange. I. N. Spencer, Box. 217, So. Manchester, Conn.

First-class telegraph instrument and attachments, and "Wood's Botany," for bound volumes of periodicals, books, or offers. H. P. Albert, Anderson, Iowa.

Wanted a book on treatment and care of canary, also breeding of same; will give in exchange book named "Market Garden, Flower Garden and Bees," or 40 "Scientific Americans" or "Seaside Libraries;" want also old books. M. J. Mulvihill, Norwalk, Conn.

Coins, minerals, stamps, books, type, fishing tackle (very complete) and fish pole, bronze inkstand, etc., for coins, medals, stamps, war envelopes, old newspapers, and Continental, Colonial and Confederate currency. F. F. Fletcher, 103 Main St., St. Johnsburg, Vt.

Blow-pipe set (cost $10), large illustrated family Bible (cost $7.50), for Wood's Botany, Dana's Geology, or printing press and type. H. W. Noble, Box 134, South Dansville, N. Y.

Wanted, offers for fossil shells from the west coast of Africa. A. W. Seward, 187 E. 71st St.

I have a number of birds' eggs I should like to trade for other birds' eggs; send for list of trading eggs. A. G. G., Box 26, Summit, New Jersey.

For a microscope stand or offers, a 36-inch turning lathe (new) and a number of scientific books; send for list. A. Kendall, Somerville, Mass.

Wanted services of amateur printer with small office (or large), in exchange for an interest in a well-established weekly paper, good size. Eagle Office, Plymouth, N. H.

American Agriculturist microscope, new, cost $15, for amateur photographic apparatus, lever watch, 22 calibre breech-loading sporting rifle or magic lantern of equal value. Wm. A. Walker, Rockland, R. I.

I. T. Bell, Franklin, Pa., has back numbers of Scientific American, Forest and Stream, and Young Scientist, good flute, chessmen, books, etc., for good magic lantern, revolver, scarce coins, or offers.

A steel spring bracket-saw, 2 doz. saw blades, and about 1 doz. patterns for a good stylographic pen or offers; send postal before exchanging. Geo. Oakley, Rutherford, N. J.

A rosewood banjo, 11 inch head, 12 nuts, fully strung, together with lot of dime banjo music and instructions, for microscope, Webster's Unabridged, monkey, squirrel and cage, or offers. J. DeWitt Clark, P. O. Box 37, Brooklyn, N. Y.

For self-inking printing press and type, one Henry rifle, 16 shot, 44 cal., cost $40, in good order, or one double barrel shot gun, barrels London fine twist, or offers. J. B. Garrison, Belton, Bell Co., Texas.

What offers for "The Chefs D'Oeuvre D'Art, Paris Exhibition 1878," cost $16, good as new, bound; 1 large photo camera, complete, cost $95; Scientific American from 1859 to 1880, 4 vols. bound. D. Keesler, Stony Point, N. Y.

Sea shells of Atlantic coast, scientifically marked, for books, old or new magazines, Indian relics, natural history specimens, apparatus; anything. Wilfred Leon Miller, P. O. Box 392, Cape May, N. J.

A new 40 diameter microscope, corals, and minerals, for a stylographic pen, air gun, or offers. J. McBride, 54 Garley St., Chicago.

A dulcimer that cost $20, books and fossils, for a telescope, microscope, fossils, Indian relics, or offers. E. J. Votaw, Salem, Iowa.

A self-inking model press, 5 x 7½, cost $23; $90 worth of scroll-saw designs in lots to suit; Scientific American, 1880; Palliser's Useful Details, $3; for photo outfit or offers. C. H. Parker, Coldbrook Springs, Mass.

Telegraph key and sounder, Frank Leslie's Illustrated Magazines, mounted microscopic objects, natural curiosities, for bull's-eye condenser, photograph camera, Unabridged Webster Dictionary, or offers. W. T. Alan, Greenville, Mercer Co., Pa.

Large magic lantern, spectroscope, pantagraph, for enlarging drawings, rosewood writing desk, man's saddle, for microscope, photo outfit or offers. Thomas Walters, Bergen St., East of Brooklyn Ave., Brooklyn, N. Y.

Model card press, chase 3¼ x 5¼, with 4 fonts type, cases, etc., for good foot lathe. Mills Day, 2 Farmington Av., Hartford, Ct.

French microscope, inclines to any angle, delicate fine motion, neat upright case, cost $17.50, for scientific books; send list to W. Fitz, P.O. Box 2852, New York.

Wanted, Quinby's New Bee Keeping, for Our Own Birds of the United States, by W. S. Baily; new. Joseph Anthony, Jr., Coleta, Whiteside Co., Illinois.

Printing type, small pica; large and small capitals, and small letters; 60 to 65 lbs., including two large cases; also gothic nonpareil, for trade. J. Siler, 1242 Broadway, St. Louis, Mo.

One years' copy of Aldine, cost $5.50, and German accordion, with instructions how to use it, cost $5.00, for offers. Chas. Dempwolf, 86 Benson St., Paterson, N. J.

A Novelty printing press, with type, prints a form 5 x 7 inches, cost $40.00, for a microscope, photographic apparatus, or offers. T. W. Patterson, Warsaw, N. Y.

$80 worth of (nearly new) printing material, minerals, fossils, Aboriginal relics, etc., for scientific books, good American watch, and offers. F. M. Farrell, Cobden, Union Co., Ills.

Rocks, minerals, fossils and fresh water shells for microscope stand, $20 to $75, also for objectives, turning lathe type, and tools. D. D. Babcock, South Dansville, N. Y.

Magic lantern, in good order, condensing lens, 2½ in. diameter, 8 slides. For small photographic camera or offers. H. A. Giddings, 4 Union Place, Classon Ave., Brooklyn.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

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Give the Boys Tools.

GIVE the boys tools and let them cut, chip and whittle to their heart's content. He will be a poor kind of a boy that will not use a knowledge of tools with advantage to himself and friends. The following extract from a lecture by James Parton, the biographer, contains a great deal of sound sense on the subject, the remarks are intended more particularly for college students, but in a measure they are applicable to the condition of all boys. A knowledge of tools and their uses, will necessarily lead the young mind to inquire into the nature of the materials on which the tools are to be employed, and this again leads to other inquiries, and thus, step by step, boys may be led on to the acquisition of the most useful and practical kind of knowledge. Indeed, parents should make it a point to see too it that their boys have tools and appliances of a kind they desire, and they should be encouraged in their use and permitted to do whatever odd jobs may be needed about their homes. The advantages of being able to perform a good piece of work are incalculable to a young man, and must be quite obvious to every sensible and thoughtful parent.

Mr. Parton says: "The attempt, I trust, is about to be abandoned to educate human beings through the brain alone. The hand, the wonderful human hand, will perhaps soon resume its part in education. It is only by discipline and by labor that the world can be conquered. The military cadet has an exceptional advantage in being able to learn his trade and get his knowledge at the same time. Three years ago I visited Cornell, and was told that nothing was more successful than the machine-shops. At Eton, one of the most aristocratic of the English public schools, the students, the year before last, made a five horse-power steam-engine which is used in their shops for turning their lathes. All the elder boys have

their separate forges. The education which leaves the hand undextrous and the arm puny is not culture, but degeneracy. Let us not forget that the men who have made America have all been educated by head and by hand, and the men who have misled America have been educated otherwise. Washington used four trades, three of which he knew thoroughly. Jefferson knew three or four trades. Franklin, besides being an excellent printer, was a jack-of-all-trades, and, contrary to the proverb, very good at several of them. Look through the history of one hundred men who have become illustrious, and you will find that the majority of them had their heads knocked against something hard in their early days. Dickens working in the blacking-shop is an example. I have in my mind's eye a glorious university, completely organized and equipped to afford an education such as the future man will be given. It looks not at all like Oxford or Cambridge, or even like Harvard. It looks more like a factory village situated in the midst of a finely cultivated farm of 1,000 acres, with beautiful gardens and parks, the whole the centre of a thriving industry such as our factory villages might be, must be, shall and are just going to be, for man will not long be the submissive vassal that he is now. This university of mine shall have a chime of bells, which, at six A.M. summons 2,000 men to rise and cast off sloth, and put on working men's clothes and prepare for labor. At seven they are in their different shops, workers in wood, in metals, in leather, in stone, in hemp, in cotton, in flax, in wool. For three hours they labor, being held to a strict account for the use or abuse of tools, material, and time. In summer a portion of each day is spent by all upon the land, so that all may have insight, some practical knowledge, of farming, of horses, of cattle, of the dairy, the garden, the orchard. At ten, all this is over, except in harvest-time or other periods of pressure. The chimes now send these workmen to their rooms, where they remove the dress and the garments of manual labor, and come out to class, and remain all day university students."

While we do not quite agree with all that the speaker puts forth in the foregoing extract, we are satisfied he has struck the right chord, and we hope that not only all our colleges will have workshops attached to them, but that our common and grammar schools will have workshops and laboratories connected with each and every one of them. After all, it is not great military heroes that make a nation mighty, it is the combined efforts of physical science and industry that build a lasting empire.

That nation is greatest that possesses the greatest number of intelligent workers.

Christmas Gifts.

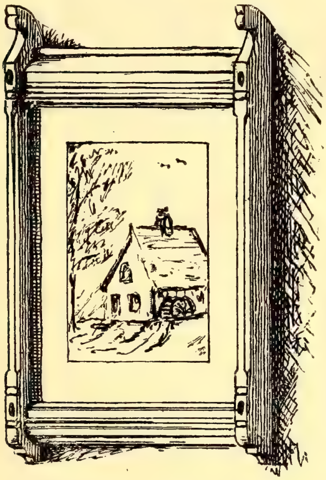
BY "OUR NED."

THE time-honored custom of making Christmas gifts to those we love is one we all revere. Doubtless many of our older readers can look back to the days of their youth, and with pleasurable feelings recall to mind many little gifts that were made and received, gifts that were made by hands that are now stilled in death, and which have acquired a value on this account, that gold or silver cannot equal; but how much more do we prize a gift if we know it to be the work of the hands that gave it? Indeed a gift, the product of the hands that makes it, possesses a two-fold value—the actual value of the gift, and any value we may attach to it as being the work of the hands of the giver—and this leads us to suggest that many of our readers might make, between now and the coming holidays, some little piece of workmanship that would be useful, lasting, and pretty, for gifts to their friends, and which, we are sure, would be appreciated much more by the recipients than if the presents were some of the dainty glittering articles that are now offered for sale at most of the fancy stores.

To aid the young worker in this object the following suggestions are offered with a view of helping him to decide what articles to make, and to assist him in making them. It is also proposed to

give the girl a chance to either help their brothers or near friends to make the articles, or to decorate them after they are made, or to make something of their own accord.

Now, let us suppose Robert has an uncle he wants to give something to; he looks about in his uncle's room and spies a place on the wall where a picture ought to hang to break the dead surface. It immediately occurs to Robert that one of the best things he can do is to make a nice picture frame for the vacant spot and give it to Uncle Joe for a Christmas gift. Robert has some knowledge of tools, and has a fair supply of them, besides having a foot-lathe and a well-built scroll-saw. He goes to work and makes a frame like the one shown in the cut.



The frame is made to receive glass 12 x 16 inches, and has the sides made of cherry, oak or other wood, one inch thick and one inch and three-quarters wide. The ends of the side are made a little ornamental by being shaped with the scroll-saw. The front edges are chamfered, or bevelled off as may be seen by examining the cut. The top piece is about an inch and a quarter thick and two inches wide, and is worked to the shape shown; it falls back from the front about half an inch, but is flush on the back and rebated to received the glass. The bottom piece is about one and a quarter inches thick, and one and a half inches wide, and is worked to shape by planes or chisels. The whole is made of cherry, oak or other suitable wood that may be handy. The top and bottom pieces may be fastened into the sides by tenon and mortise, or may be doweled and well glued in. Other modes of fastening will suggest themselves, but Robert adhered to the good old honest tenon and mortise, as he thought it the strongest and most durable. When the frame was completed and nicely sand-papered until it was smooth and clean, Robert thought he would like to ebonize it, that is, make it appear like ebony. To do this he turned over to page 156 of his *Workshop Companion*, and found that he had to apply a boiling decoction of logwood to the work three or four times, allowing it to dry before the next washing took place. When the fourth coat was perfectly dry the whole was washed with a solution of acetate of iron, which he made by dissolving iron filings in vinegar. This made an excellent stain as it penetrated to some considerable distance into the wood.

At this juncture the frame looked like a solid piece of ebony unpolished and rather rough. He smoothed it down again with very fine sandpaper, and rubbed it with a linen cloth. The dead black, however, did not look so nice as he thought it would, so he bought a bottle of liquid gold at the nearest store where artists' supplies were kept. With this gold he touched up the cross indentations on the sides of the frame, and "cut in" some very fine lines on the top and bottom pieces. This process relieved the work wonderfully and gave the frame a real artistic appearance. He then gave the whole work two or three coats of thin shellac varnish, and rubbed the whole down with finely powdered pumice stone applied with a clean cloth and water.

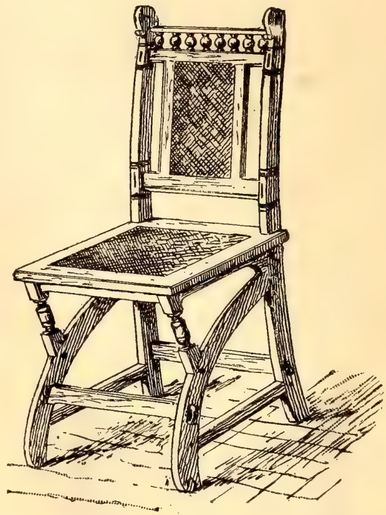
The frame being finished, Amy, Robert's sister, undertook to furnish a picture to fill the frame. She had some knowledge of drawing, not much to be sure, but just enough to be able to illustrate a flower, a spray, or a simple landscape, and her

knowledge of coloring, though limited, was always guided by good taste. Of course she used her best efforts to make Uncle Joe a picture, and the result was a very decent sketch of an old mill done in monochrome or single color.

Amy also made another picture for the frame that looked very well, but after consideration, she decided to give Uncle Joe the sketch of the mill. The other picture was formed by taking one of the statue pictures, that are so abundant in many of our pictorial papers, and cutting the paper carefully away from the picture all round, leaving only the pedestal or stand along with the statue. When this is satisfactorily done the print is carefully pasted on a back-ground of black velvet, when a beautiful picture is obtained, which when framed with an oval arched headed, grey pebbled mat, is very pleasing, and more particularly so when a spray of leaves or flowers is painted in appropriate colors on one side of the mat, as Amy treated her picture.

Robert was very well pleased with the result of his labors and determined to continue them, but in another direction. Robert had an aunt as well as an uncle. Robert was fond of his aunt, and it was a matter of pleasure as well as of duty to make her something, but the question was "what will I make her?" He finally decided to make her a chair, and the style of chair chosen is shown in the engraving. He chose this style of chair because it is easily made and would give him an opportunity to use both his scroll saw and lathe.

The chair is made of white ash, and is put together very strongly with mortises and tenons. The frame-work in the back is formed of stuff one inch by one and a half inch, with the exception of the bottom piece, which is two inches wide. The little rail on the top of the turned spindles, is one inch by three-quarters of an inch laid flatways on the turned work. The spindles are two inches long from shoulder to shoulder, and are turned to shape in the lathe. A pin three-eighths in diameter and about a half an inch long is left on each end of the spindles. These pins go into holes made in the two top cross rails as shown. Care is required in boring the holes in the upper rail so that they may not go through and show on the top of the work.



The back uprights show one and a quarter inches in thickness and two inches in width, and are two feet ten inches high from the floor. A cross rail, not seen in the engraving, is framed in between the uprights. Another rail is framed in lower down, as shown. The segmental or curved pieces forming the front legs, are the same thickness and width as the back legs. The turned uprights are one and a quarter inches square, and have on their top ends pins to hold the seat, and on their lower ends tenons to fit snugly into mortises made in the curved pieces.

The lower rails are made of stuff one by one and a half inches and are tenoned to fit in mortises made in the several legs. The frame for the seat is made from stuff one by one and three-quarter inches, and is framed together with mortise and tenon.

Previous to commencing work Robert made a full sized rough pencil drawing of the chair on the floor, making all the dimensions the same as here described; this enabled him to get all his lengths, curves and shoulders accurately. The seat and back were rebated on their inside

inner edges to receive the frame work for cushions made by his sister Amy.

Robert made a complete success of the work, and the gifts were fully appreciated by his uncle and aunt, and were prized much more than if they had been bought at a first-class furniture store.

Now there is no reason why some of our boys who possess a few tools should not follow the example of Robert and make up between this and the coming holidays something to give to their friends. It is not necessary that they should all make picture frames or chairs, there are hundreds of other little things they may make, such as wall brackets, hanging cabinets, card baskets, foot stools, toilet stands, work-boxes, window cornices, spool stands, jewel cases, pen-holders, photo-frames, towel-racks, etc.

Wall and corner brackets may be made of plain pine boards, with but little ornamentation; they may be stained or simply varnished and then handed over to the girls to drape with fringes, knitted or embroidered work.

A very pretty and inexpensive toilet stand, suitable as a gift to a lady friend, may be made by using an old four-legged stand, or by making a rough stand, or by using a dry-goods box of the right dimensions. Cover the top with cambric, blue or pink. Draw this over it nicely and tack it firmly round the edge, then take a piece of cambric, same color, and long enough to go around three sides and wide enough to reach from the top of stand to the floor. Cut a piece of cheese cloth twice the length of the cambric and the same width, and allow an inch and a half for hem. Fell the edge opposite the hem and tuck under the edge of the stand. Finish the edge and just above the hem with a notched box plaiting about two inches wide of the cambric covered with the cheese cloth and nail in place with bright headed tacks. The effect, when finished is quite pleasing.

There are many other things that might be treated in this simple way; for instance, a small box whose dimensions are about twelve inches long, eight wide and from six to eight inches high, could be made into a very handsome footstool.

Boy Inventors.

THE *Christian Advocate* justly considers that a boy's elders are guilty of a foolish act when they snub him because he says or does something which they don't understand. A boy's personality is entitled to as much respect as a man's, so long as he behaves himself. In the following anecdotes wise and foolish elders are exhibited—one class respecting, and the other despising a boy.

Some of the most important inventions have been the work of boys. The invention of the valve motion to the steam engine was made by a mere boy.

Newcomen's engine was in a very incomplete condition, from the fact that there was no way to open or close the valves, except by means of levers operated by hand.

He set up a large engine at one of the mines, and a boy, Humphrey Potter, was hired to work these valve-levers; although this is not hard work, yet it required his constant attention.

As he was working the levers he saw that parts of the engine moved in the right direction, and at the same time that he had to open or close the valves.

He procured a strong cord, and made one end fast to the proper part of the engine, and the other end to the valve-lever; and the boy then had the satisfaction of seeing the engine move with perfect regularity of motion.

A short time after the foreman came around and saw the boy playing marbles at the door. Looking at the engine he saw the ingenuity of the boy, and also the advantage of so great an invention. The idea suggested by the boy's inventive genius was put in a practical form, and made the steam engine an automatic working machine.

The power loom is the invention of a farmer's boy who had never seen or heard of such a thing.

He whittled one out with his jackknife, and after he had got it all done, he, with great enthusiasm, showed it to his father, who at once kicked it to pieces, saying he would have no boy about him that would spend his time on such foolish things.

The boy was sent to a blacksmith to learn a trade, and his master took a lively interest in him. He made a loom of what was left of the one his father had broken up, and showed it to his master.

The blacksmith saw he had no common boy as an apprentice, and that the invention was a valuable one. He had a loom constructed under the supervision of the boy. It worked to their perfect satisfaction, and the blacksmith furnished the means to manufacture the looms, and the boy received half the profits. In about a year the blacksmith wrote to the boy's father that he should bring with him a wealthy gentleman who was the inventor of the celebrated power loom.

You may be able to judge of the astonishment at the old home when his son was presented to him as the inventor, who told him that the loom was the same as the model that he had kicked to pieces but a year ago.

Our Patent Office shows many ingenious and useful inventions made by minors and women, and the above list of important inventions made by boys might be largely increased did space permit.

Although the foregoing is not strictly in accordance with facts, it offers food for thought for the boys, as it indicates what might be done by those of an ingenious turn of mind and who receive fair encouragement from their parents and friends. We have often seen young folks, both boys and girls, who have been brought to their "wits end" in some little matter suddenly get out of the difficulty, by devising some before unknown means, thus proving that there is some truth in the old adage that "necessity is the mother of invention," but in the main it is better for boys to understand that no great invention is ever likely to be made without thought and proper preparation. Work is the only certain road leading to success in invention, as it is in obtaining knowledge.

— A teaspoonful of salt to a quart of the soil in plant boxes will kill the white worms.

Marvels of Pond Life.—XIV.

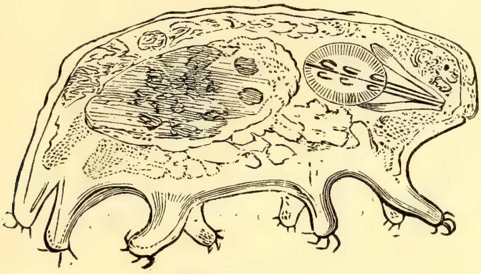
THERE is always satisfaction in finding a work accomplished; but the attempt to delineate some of the marvels of minute creation has been a pleasant one, and we approach the completion of our task of recording a *Microscopic Year* with something like regret. The dark, dirty December of the great metropolis may not seem a promising time for field excursions, but some ponds lie near enough to practicable roads and paths to render an occasional dip in them, not of ourselves, but of our bottles—an easy and not unpleasant performance; and if the weather is unusually bad, we can fall back upon our preserves in bottles and tanks, which seldom fail to afford something new, as we have been pretty sure to bring home some undeveloped germs with our stock of pond-water and plants, and even creatures of considerable size are very likely to have escaped detection in our first efforts at examination.

When objects are not over abundant, as is apt to be the case in the cold months, it is well to fill a large vial with some water out of the aquarium or other large vessel, and watch what living specks may be moving about therein. These are readily examined with a pocket-lens, and with a little dexterity any promising creature can be fished out with the dipping-tube. It is also advisable to shake a mass of vegetation in a white basin, as the larger infusoria, etc., may be thrown down; and indeed this method (as recommended by Pritchard) is always convenient. Even so small a quantity of water as is contained in a glass cell, appropriated to the continual examination of polyps or polyzoa, should be frequently hunted over with a low power, as in the course of days and weeks one race of small animals will disappear, and another take their place.

Following these various methods in December, we obtained many specimens; but the most interesting was found by taking up small branches of the Anacharis with a pair of forceps, and putting them into a glass trough to see what inhabitants they might possess. One of these trials was rewarded by the appearance of a little puppy-shaped animal very busy pawing about with eight imperfect legs, but not making much progress with all his efforts. It was evident that we had obtained one of the *Tardigrada* (slow-steppers), or Water-Bears, and a very comical amusing little fellow he was. The figure was like that of a new-born puppy, or "unlicked" bear cub; each of the eight legs were provided with four serviceable claws, there was no tail, and the blunt head was susceptible of considerable alteration of shape. He was grubbing about among

some bits of decayed vegetation, and from the mass of green matter in his stomach it was evident that he was not one of that painfully numerous class in England—the starving poor.

A power of one hundred and five linear, obtained with a two-thirds object-glass, and the second eye-piece, enabled all his motions and general structure to be exhibited, and showed that he possessed a piece or pieces, are protrusile. They were frequently brought as far as the outer lips (if we may so call the margins of the mouth), but we did not witness an actual protrusion, except when the lips accompanied them, and formed a small round pouting orifice. The skin of the animal was tough and somewhat loose, and wrinkled during the contractions its proprietor made. The interior of the body



Water-Bear.

sort of gizzard, whose details would require more magnification to bring out. Accordingly the dipping-tube was carefully held just over him, the finger removed, and luckily in went the little gentleman with the ascending current. He was cautiously transferred to a Compressorium,* an apparatus by which the approach of two thin plates of glass can be regulated by the action of a spring and a screw; and just enough pressure was employed to keep him from changing his place, although he was able to move his tiny limbs. Thus arranged, he was placed under a power of two hundred and forty linear, and illuminated by an achromatic condenser,† to make the fine structure of his gizzard as plain as possible. It was then seen that this curious organ contains several prominences or teeth, and is composed of muscular fibres, radiating in every direction. From the front of the gizzard proceed two rods, which meet in a point, and are supposed to represent the maxillæ or jaws of insects, while between them is a tube or channel, through which the food is passed. The mouth is *suctorial*, and the two horny rods, with their central

exhibited an immense multitude of globular particles of various sizes in constant motion, but not moving in any vessels, or performing a distinct circulation.

My specimens had no visible eyes, and these organs are, according to Pritchard's book, "variable and fugacious." The same authority remarks, "In most vital phenomena they very closely accord with the rotatoria; thus like these they can be revived after being put into hot water at 113° to 118°, but are destroyed by immersion in boiling water. They may be gradually heated to 216°, 252°, and even 261°. It is also by their capability of resuscitation after being dried that they are able to sustain their vitality in such localities as the roofs of houses, where at one time they are subjected to great heat and excessive drought, and at another are immersed in water."

When vital processes are not stopped by excess of temperature, as is the case with the higher animals, the power of resisting heat without destruction depends upon the condition of the albumen. Soluble albumen, or, as it should be called, *Albuminate of Soda* (for a small quantity of that alkali is present and chemically united with it), after having been *thoroughly dried*, may be heated without loss of its solubility; although if the same temperature was applied before it was dry, that solubility would be destroyed, and it would no longer be a fit constituent of a living creature. As Dr. Carpenter observes, this fact is of much interest in explaining the tenacity of life in the Tardigrada.

The movements of the water-bears, al-

* The best forms of this instrument are made by Messrs. R. & J. Beck, the glass plates being held in their places by flat-headed screws, and not by cement. This plan was devised by the author, and makes it easy to renew the glasses when broken.

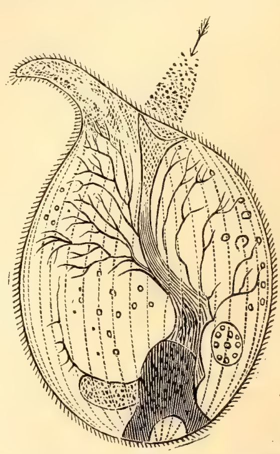
† The achromatic condenser is a frame capable of supporting an object glass lower than that employed for vision, through which the light passes to the object in quantities and directions determined by stops of various shapes. The appearances mentioned can be seen without it, though not so well.

though slow, evince a decided purpose and ability to make all parts work together for one common object; and as might be expected from this fact, and also from the repetition of distinct, although not articulated limbs, they are provided with a nervous apparatus of considerable development, in the shape of a chain of a ganglia and a brain, with connecting filaments. From these and other circumstances naturalists consider the Tardigrada to belong to the great family of *Spiders*, of which they are, physiologically speaking, *poor relations*. Siebold says "they form the transition from the Arachnoidæ to the Annelides."* Like the spiders they cast their skin; and, although I was not fortunate enough to witness this operation—called in the language of the learned *ecdysis*, which means putting its clothes off—I found an empty hide, which, making allowance for the comparative size of the creatures, looked tough and strong as that of a rhinoceros, and showed that the stripping process extended to the tips of the claws. The 'Micrographic Dictionary' states that the Tardigrada lay but few eggs at a time, and these are "usually deposited during the ecdysis, the exuviæ serving as a protection to them during the process of hatching." Thus Mrs. Water-Bear makes a nursery out of her old skin, a device as ingenious as unexpected. The water-bears are said to be hermaphrodites, but this is improbable.

The *Plumatella repens*, described in a former chapter, was kept in a glass trough, to which some fresh water was added every few days, taken from a glass jar that had been standing many weeks with growing anacharis in it. One day a singular creature made its appearance in the trough; when magnified sixty diameters it resembled an oval bladder, with a sort of proboscis attached to it. At one part it was longitudinally constricted, and evidently possessed some branched and complicated internal vessel. The surface was ciliated, and the neck or proboscis acted as a rudder, and enabled the creature to execute rapid turns. It swam up and down, and round about, sometimes rotating on its axis, at others keeping the same side uppermost, but did not exhibit the faintest sign of intelligence in its movements, except an occasional finger-like bend of the proboscis, upon which the cilia seemed thicker than upon the body. It was big enough to be observed as a moving white speck by the naked eye, when the vessel containing it was held to catch the light slantingly; but a power of one hundred and five was conveniently employed to enable its structure to be discerned. Under this power, when the animal was resting or moving slowly, a mouth was perceived on the left side of the proboscis, which was usually, though not always, curved to the right. The mouth was a round or oval orifice, and when illuminated by the parabola, its lips or margin looked thickened, and of a pale blue, and ciliated, while the rest of the body assumed a pinkish pearly tint.

Below the mouth came a funnel-shaped tube or œsophagus, having some folds or plaits on its sides, and terminating in a broad digestive tube, distinct from the nucleus, and ramifying like a tree. The constriction before mentioned, which was always seen in certain positions, although it varied *very considerably* in depth and width, drew up the integument towards the main trunk of the digestive tube, and thus the animal had a distinct ventral and dorsal side. The branches of the tube stopped somewhat abruptly just before reaching the surface, and were often observed to end in small round vacuoles or vesicles.

At the bottom of the bladder, opposite the mouth, in some specimens were large round cavities or cells, filled with smaller cells, or partially transparent granules. These varied in number from one to two or three, and were replaced in other specimens by masses that did not present the same regular form or rounded outline. In one instance an amorphous structure of this kind gradually divided itself, and seemed in the course of forming two cells, but the end of the process was unfortunately not seen. The annexed



Trachelius ovum (slightly flattened). × 105.

drawing will readily enable the animal to be recognized. It shows the mouth very plainly, and a current of small particles

* 'Anatomy of the Invertebrata,' Burnett's trans., p. 364.

moving towards it. The œsophagus terminates in a digestive tube, like the trunk of a tree, from which numerous branches spring. This arrangement is probably analogous to that of the phlebenterous mollusks described by Quatrefages, in which the ramifications of the stomach answer the purpose of arteries, and convey the nutrient fluid to various parts of the body. It is also likely that they minister to the function of respiration.

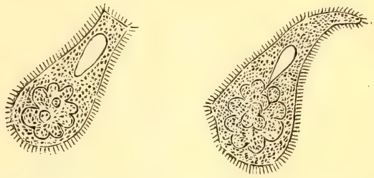
The cilia on the surface, which are arranged in parallel lines, are best observed when the animal is slightly flattened in a live-box; but this process produces a considerabie derangement in the relative position of the internal parts, and they can only be well seen when it is immersed in plenty of water, and is polite enough to stand still, and submit his digestive economy to a steady gaze. The only way to succeed in this undertaking is to have a large stock of patience as well as a convenient cell or trough. The table must be kept steady, and the prisoner watched from time to time, and at last he will be found ready for display.

Pritchard says this animal, whose name is *Trachelius ovum*, is an inhabitant of stagnant bog water, and has been found encysted. My specimens could not be called plentiful, but for several weeks I could generally find two or three, by filling a four-ounce vial from the glass jar, and examining its contents with a pocket-lens. If none were present, another dip was made, and usually with success.

One evening I caught a good specimen by means of the dipping-tube, and cautiously let it out, accompanied by a drop of water, on the glass floor of the live-box. A glance with the pocket-lens showed all was right, and the cover was very gently put on, but it had scarcely touched the creature when it became crumpled up and in confusion. On one or two former occasions I had been unfortunate enough to give my captives a squeeze too much, with the usual result of a rupture of their integuments and an escape of globules and fluids from the regions within. Now, however, there was no such rupture and no such escape, but instead of a smooth, comely surface, my Trachelius had lost all title to his specific designation, *ovum*, for instead of bearing any resemblance to an egg, it was more like an Irishman's hat after having a bit of a "shindy" at Donnybrook Fair.

I was greatly puzzled with this aspect of things, and still more so when my deranged specimen twirled and bumped about with considerable velocity, and in all directions. Presently a decided constriction appeared about half-way below the mouth and proboscis, and in transverse direction. The ciliary motion became very violent in the lower half just below the constriction, while the proboscis worked hard to make its half go another way. For some minutes there was a tug of war, and at length away went proboscis with his portion, still much crumpled by the fight, and left the other bit to roam at will, gradually smooth his puckers, and assume the appearance of a respectable well-to-do animalcule.

Three hours after the "fission" the proboscis half was not unlike the former self of the late "entire," but with diminished body and larger neck; while the remaining portion had assumed a flask form, and would not have been known by his dearest acquaintance. The portraits of the *dis-United States* were quickly taken, and, as bed-time had arrived, they



Trachetius ovum, three hours after division. $\times 60$.

were left to darkness and themselves. The next morning a change had come over the "spirit of their dream." Both were quiet, or sedately moving, and they were nearly alike. The proboscis fellow had increased and rounded his body, and diminished his nose; while Mr. Flask had grown round also, and evinced an intention of cultivating a proboscis himself. Twenty-seven hours after the separation, both had made considerable progress in arranging and developing their insides, which had been thrown into great confusion by the way in which the original animal had been wrenched in half, and in both a granular mass was forming opposite the mouth end. The proboscis portion, which may perhaps be termed the *mother*, was more advanced than her progeny, but both had a great deal to do if they meant to exhibit the original figure, and develop a set of bowels as elegantly branched. Whether they would have succeeded or not under happier circumstances I cannot tell, but unfortunately the Fate who carries the scissors cut short their days.

In all other animalcules in which I had observed the process of multiplication by self-division, it seems to go on smoothly, and with no discomfort to either the dividend or the quotient, and it may be that in the fission of the *Trachelius ovum* I witnessed what the doctors would call a bad case. Indeed it may have been pre-

maturely brought on, and aggravated by the squeeze in the live-box. It is, however, probable, from the stronger texture and greater organic development of this animalcule, that it does not divide so easily as the softer and simpler kinds.

Frequent examination of this animalcule has created a strong doubt in my mind whether it is rightly placed in our "systems." My own impression is that it belongs to a higher class.

Feather Cloth.

THIS novel and beautiful fabric is more and more prized as it becomes more widely known. Those of our readers who are familiar with the processes of ordinary cloth manufacture will appreciate the following description of the method of making feather cloth, which we take from the *Textile Manufacturer:*

The manufacture of feather cloth is not difficult, and the machines used in an ordinary woolen mill are suitable for the purpose with but slight modifications. When the down has been pulled off the feathers it is ready to be mixed with any textile material, such as cotton, silk, or wool, but the latter is the most suitable on account of its softness. Down may even be spun by itself, but this is seldom done. The mixture most to be recommended is 70 lbs. to 80 lbs. down, 100 lbs. to 120 lbs. olein, wool 40 lbs. to 60 lbs. To unite these three they are placed in alternate layers upon each other on a floor, and are then passed through a cock heel willy, making 400 to 500 turns per minute, and then brought to the scribbler. The main cylinder of this engine should run only about 35 to 45 revolutions per minute, instead of 100 to 110 as with pure wool. All rollers, clearers and doffer must be speeded in proportion. India rubber clothing is the best for this work, and must not be too fine, while the rollers should be set pretty close. When passing out of the scribbler the mixture is allowed to fall on the floor, and removed by a girl to the carding engine. In doing this the attendant examines the mixture a little to remove any whole feathers which may have passed.

The carding engine runs at the same speed as the scribbler, and is, in other respects, like it. The mixture does, however, not fall on the floor, but is passed on a sheet of cotton cloth, which is rolled up behind the engine, and rolls up the lap coming from it, so that the latter remains perfectly separated, and cannot be compressed.

— Flour dusted on cabbages when the dew is on, will kill off cabbage worms. Probably by closing the pores of the worms.

A River of Hot Water.

The great Sutro Tunnel, cut to relieve the celebrated Comstock mines at Virginia City, Nevada, of vast quantities of hot water which is encountered in them, affords an outlet of 12,000,000 tons every twenty-four hours. Some of the water, as it finds its way into the mines, has a temperature of 195 degrees, while four miles from the mouth of the tunnel the temperature ranges from 130 degrees to 135 degrees. To obviate the inconvenience which would arise from the vapor such a vast quantity of water would give off, the flow is conducted through the entire tunnel, four miles, in a tight flume made of pine. At the point of exit the water has lost but seven degrees of heat. Sixty feet below the month of the tunnel the hot water is utilized for turning machinery belonging to the company, from whence it is carried off by a tunnel 1,100 feet in length, which serves as a waterway. Leaving the wasteway tunnel, the water flows to the Carson River, a mile and a half distant. This hot water is being utilized for many purposes. The boys have arranged several pools where they indulge in hot baths. The miners and others use it for laundry purposes, and arrangements are being made whereby 1,000 acres belonging to the company are being irrigated. It is proposed to conduct the hot water through iron pipes beneath the surface of the soil, near the roots of thousands of fruit trees which are to be planted, and in a similar manner giving the necessary warmth to a number of hot-houses to be used for the propagation of early fruits and vegetables.

Curious Changes of the Planet Mars.

Astronomers have lately been much puzzled at certain remarkable changes that have been observed to be taking place on the surface of our neighboring planet Mars, and many speculations as to their real nature and significance have been ventured, though as yet they are mere vague guesses.

The changes here referred to first arrested the attention of astronomers at the time of the brilliant opposition of Mars in 1877, when his two satellites were discovered. It was then that the existence of a number of long, narrow streaks, forming a sort of network over his surface, was also discovered. At the subsequent opposition of 1879–80, Prof. Schiaparelli, Director of the Observatory of Milan, detected these same long, narrow streaks crossing the Martian disk in all directions, and which, bearing more resemblance to canals than anything else, have since been so designated. These canals Schiaparelli carefully examined, and made accurate drawings of them.

At the opposition of 1881-82, Schiaparelli again had an opportunity of making an examination of this remarkable feature of the Martian topography, and made some discoveries concerning them that are both curious and astonishing. He found, in the case of many of the canals of which he had made faithful drawings during his earlier observations, that they had become divided and subdivided by a number of parallel lines running through them.

The most singular discovery is yet to be named. He was enabled to actually observe the progressive development and duplication of these canals in about twenty instances, between the 19th of January and the 24th of February.

From the eminence of the observer there can be no doubt of the entire reliability of these astonishing observatlons. Schiaparelli has noticed other changes going on on the surface of our neighbor planet—notably, a considerable enlargement of one of the supposed oceanic bodies of Mars, known to astronomers as the Kaiser Sea, and the variable brightness of certain other regions.

The next opposition of Mars, which will take place on the 31st of January, 1884, will be anticipated with much interest by astronomers. Some of the great telescopes, now in the course of construction, will by that time have been completed and erected, and, in the hands of distinguished astronomers, it may be that the nature of the mysterious and pronounced changes now taking place on Mars may be unravelled. As they concern the celestial body, which, next to our own satellite, is nearest to the earth, the phenomena above noticed have universal interest.

Cold Gold Plating.

We give the following, which professss to be taken from the *Uhrmacher Zeitung* as a fair sample of many of the recipes which find a place in the so-called technical journals:

Silver, German silver, copper, brass, and pinchbeck will each take a fine plating and polish by the following method, requiring neither heat nor electricity during the operation.

To prepare the gold powder, dissolve some pure gold in nitro-muriatic acid until the acid becomes so saturated with the metal that it ceases to absorb it; then soak up the liquid with fine linen rags, lay them aside till thoroughly dried, when they should be lighted and allowed to consume themselves quietly to ashes. In this way you procure pure gold in the finest possible powder.

If you wish to have your plating of a reddish tinge, copper must be added to the solution in the proportion of six parts gold to one part pure copper, dissolved in sixteen parts nitro-muriatic acid, dried and burned on linen rags as just described.

The article to be plated must be carefully cleansed and smoothed before commencing the operation. Then hold the end of a smooth cork an instant in the flame of your lamp, dip it in vinegar or salt and water, and apply the gold powder with it to the metallic surface to be plated, rubbing it in with care and energy until the coating of gold is of the required thickness.

Polish with a piece of manganese, or a burnisher wet with soft water in which a little soap has been dissolved. In performing this operation great care must be taken not to allow the acid to touch the hands, especially if there is any bruise or scratch upon them.

This recipe has been extensively copied, and always without a word of comment, and yet any person having the slightest knowledge of chemistry must know that it will not work. The process consists simply in preparing very finely divided metallic gold, but every one knows that this will not adhere to copper or brass by simple friction. The addition of a little mercury so as to form an amalgam, and the subsequent removal of the mercury by heat would convert it into a very fair recipe.

Practical Hints.

The longest span of wire in the world is used for a telegraph in India over the river Kistnah. It measures more than 6,000 feet and is stretched between two hills, each of which is 1,200 feet high.

Adhesive Cement.—Intimately mix finely-pulverized gum arabic with its weight of very finely powdered calcined alum. When mixed with a small quantity of water, it forms a cement which unites wood, paper, porcelain, glass and crockery very firmly. Must be kept dry in powder, and moistened only as needed.

Removing Grease from Bird Skins.—Although it is not an easy task to remove grease either from the inside or outside of a bird skin, yet it can be accomplished by the following methods, seconded with a little patience: If the inside is greasy sprinkle liberally with plaster of Paris, and scrape with a blunt knife, renewing the plaster from time to time so as to thoroughly absorb the grease. Should a bird's feathers be greasy—and in a white bird the chances are nine to one that they will be—wash the greasy places freely with spirits of turpentine, and then pour on plaster, replacing it with fresh as soon as it has become saturated with turpentine, at the same time brushing and moving the feathers about in order that the plaster may penetrate. Finish by beating with a light, elastic stick to remove all the plaster. As may be supposed, this is a somewhat tedious process, especially if the bird be large, but the results are excellent and well worth the trouble. The best time to cleanse a bird that is being mounted is after it has been wired and sewed up, but before placing on a perch.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business matter in letters or cards they are filed away and never reach the printer.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

Wanted engraver's tools with book of instructions, for a Victor Press, with cabinet, 2 type cases, type, ink roller and furniture complete; perfectly new. L. Warren, 72 Cumberland St., Brooklyn, N. Y.

A Fletcher Foot-Blower, cost $5, as good as new; will exchange for a Cushman, 2 in. or up scroll chuck, or other make; will give a satisfactory trade on the difference in price, if any. Louis Lutz, St. Clair Street, Toledo, O.

I have a lot of "Galaxy" (magazines) which I would like to exchange for an air rifle in good condition, a collection of birds' eggs, or offers. W. B. Greenleaf, 480 La Salle Ave., Chicago, Ill.

I have a Mechanical Telegraph with book of instructions, books, etc., which I wish to exchange for good microscopical objects, mounted on 3 x 1 slips. Address, with list, J. H. Frey, Millersburg, Ohio.

To exchange, "How to Use Microscope," Wells' "Natural Philosophy," and many other books, chemical apparatus, etc., for good photographic camera, and lenses. W. H. Weed, 254 Putnam Ave., Brooklyn, N. Y.

Wanted "Quimby's New Bee Keeping," for "Our Own Birds of the United States," by W. S. Baily; new. Joseph Anthony, Jr., Colota, Whiteside Co., Ill.

Wanted a good book in anatomy, in exchange for a book on chemistry, or for story books. A. G. G., Box 26, Summit, New Jersey.

A German-silver trimmed, patent lined, cocoa flute, cost $4, in good order, for good spy-glass, photo-material, or offers. Ewing McLean, Greencastle, Ind.

I have some fossil shells from the west bank of the Mississippi, to exchange for Indian relics. A. W. S., 187 E. 71st St., N. Y.

I have a magic lantern, Ruby pattern, nearly new, and 5 views; also "Our First Century," bound in leather, cost $7; state what is wanted in exchange. I. N. Spencer, Box. 217, So. Manchester, Conn.

First-class telegraph instrument and attachments, and "Wood's Botany," for bound volumes of periodicals, books, or offers. H. P. Albert, Anderson, Iowa.

Wanted a book on treatment and care of canary, also breeding of same; will give in exchange book named "Market Garden, Flower Garden and Bees," or 40 "Scientific Americans" or "Seaside Libraries;" want also old books. M. J. Mulvihill, Norwalk, Conn.

Coins, minerals, stamps, books, type, fishing tackle (very complete) and fish pole, bronze inkstand, etc., for coins, medals, stamps, war envelopes, old newspapers, and Continental, Colonial and Confederate currency. F. F. Fletcher, 103 Main St., St. Johnsburg, Vt.

Blow-pipe set (cost $10), large illustrated family Bible (cost $7.50), for Wood's Botany, Dana's Geology, or printing press and type. H. W. Noble, Box 134, South Dansville, N. Y.

Wanted, offers for fossil shells from the west coast of Africa. A. W. Seward, 187 E. 71st St.

I have a number of birds' eggs I should like to trade for other birds' eggs; send for list of trading eggs. A. G. G., Box 26, Summit, New Jersey.

For a microscope stand or offers, a 36-inch turning lathe (new) and a number of scientific books; send for list. A. Kendall, Somerville, Mass.

Wanted services of amateur printer with small office (or large), in exchange for an interest in a well-established weekly paper, good size. Eagle Office, Plymouth, N. H.

American Agriculturist microscope, new, cost $15, for amateur photographic apparatus, lever watch, 22 calibre breech-loading sporting rifle or magic lantern of equal value. Wm. A. Walker, Rockland, R. I.

I. T. Bell, Franklin, Pa., has back numbers of Scientific American, Forest and Stream, and Young Scientist, good flute, chessmen, books, etc., for good magic lantern, revolver, scarce coins, or offers.

A steel spring bracket-saw, 2 doz. saw blades, and about 1 doz. patterns for a good stylographic pen or offers; send postal before exchanging. Geo. Oakley, Rutherford, N. J.

A rosewood banjo, 11 inch head, 12 nuts, fully strung, together with lot of dime banjo music and instructions, for microscope, Webster's Unabridged, monkey, squirrel and cage, or offers. J. DeWitt Clark, P. O. Box 37, Brooklyn, N. Y.

For self-inking printing press and type, one Henry rifle, 16 shot, 44 cal., cost $40, in good order, or one double barrel shot gun, barrels London fine twist, or offers. J. B. Garrison, Belton, Bell Co., Texas.

What offers for "The Chefs D'Oeuvre D'Art, Paris Exhibition 1878," cost $16, good as new, bound; 1 large photo camera, complete, cost $95; Scientific American from 1859 to 1880, 4 vols. bound. D. Keesler, Stony Point, N. Y.

Sea shells of Atlantic coast, scientifically marked, for books, old or new magazines, Indian relics, natural history specimens, apparatus; anything. Wilfred Leon Miller, P. O. Box 392, Cape May, N. J.

A new 40 diameter microscope, corals, and minerals, for a stylographic pen, air gun, or offers. J. McBride, 54 Garley St., Chicago.

A dulcimer that cost $20, books and fossils, for a telescope, microscope, fossils, Indian relics, or offers. E. J. Votaw, Salem, Iowa.

A self-inking model press, 5 x 7½, cost $23; $90 worth of scroll-saw designs in lots to suit; Scientific American, 1880; Palliser's Useful Details, $3; for photo outfit or offers. C. H. Parker, Coldbrook Springs, Mass.

Telegraph key and sounder, Frank Leslie's Illustrated Magazines, mounted microscopic objects, natural curiosities, for bull's-eye condenser, photograph camera, Unabridged Webster Dictionary, or offers. W. T. Alan, Greenville, Mercer Co., Pa.

Large magic lantern, spectroscope, pantagraph, for enlarging drawings, rosewood writing desk, man's saddle, for microscope, photo outfit or offers. Thomas Walters, Bergen St., East of Brooklyn Ave., Brooklyn, N. Y.

Model card press, chase 3¼ x 5¼, with 4 fonts type, cases, etc., for good foot lathe. Mills Day, 2 Farmington Av., Hartford, Ct.

French microscope, inclines to any angle, delicate fine motion, neat upright case, cost $17.50, for scientific books; send list to W. Fitz, P.O. Box 2852, New York.

Wanted, Quinby's New Bee Keeping, for Our Own Birds of the United States, by W. S. Baily; new. Joseph Anthony, Jr., Coleta, Whiteside Co., Illinois.

Printing type, small pica; large and small capitals, and small letters; 60 to 65 lbs., including two large cases; also gothic nonpariel, for trade. J. Siler, 1242 Broadway, St. Louis, Mo.

One years' copy of Aldine, cost $5.50, and German accordion, with instructions how to use it, cost $5.00, for offers. Chas. Dempwolf, 86 Benson St., Paterson, N. J.

A Novelty printing press, with type, prints a form 5 x 7 inches, cost $40.00, for a microscope, photographic apparatus, or offers. T. W. Patterson, Warsaw, N. Y.

$80 worth of (nearly new) printing material, minerals, fossils, Aboriginal relics, etc., for scientific books, good American watch, and offers. F. M. Farrell, Cobden, Union Co., Ills.

Rocks, minerals, fossils and fresh water shells for microscope stand, $20 to $75, also for objectives, turning lathe type, and tools. D. D. Babcock, South Dansville, N. Y.

Magic lantern, in good order, condensing lens, 2½ in. diameter, 8 slides. For small photographic camera or offers. H. A. Giddings, 4 Union Place, Classon Ave., Brooklyn.

The Young Scientist

SCIENCE IS KNOWLEDGE. KNOWLEDGE IS POWER.

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Scroll-Sawing Woods.

MANY of our best scroll sawyers seldom use more than two kinds of wood, black walnut and white holly, and now and again cherry and butternut. These woods, of course, are all very well, and by a proper harmonization may be made to appear very handsome when worked together. These varieties, however, do not exhaust the list of woods suitable for the scroll-saw outfit. True, black walnut and holly rate very high, both on account of their colors and fine qualities, but we must say that oak or ash might frequently be used in place of the lighter wood, where a strong contrast is not needed. Holly is very nice for card baskets, small photo frames, silhouettes, or mottos, but is not adapted for large baskets, cabinets, or other large work. Indeed, holly soon loses its fine creamy-white color if it is left exposed to the air for any length of time, and then looks like basswood or poplar. Brackets should be made of walnut, oak, or mahogany, and mottos of holly; and when the latter is nicely glued on a dark ground of fine black walnut, and surrounded with an appropriate frame, it shows that the maker—to my mind—possessed a proper sense of the "fitness of things."

Flies and dust are among the worst enemies of fret work, and it does seem as though they preferred to roost on white holly more than on any other wood. The white wood may be protected some little by varnishing it with a coat of bleached shellac before it is cut. It would also be well to use thin pieces of basswood, pine, or other cheap soft wood on each side of it, the upper one to paste the pattern on, the lower one to prevent any beard from forming on the holly. The three pieces should be tacked together with the holly in the centre, of course. When fret work is cut this way it saves time, as no sand-

papering is necessary, and the finest and most complex pattern may be cut out with great ease. Under no consideration whatever should common varnish or oil be used on holly; it would spoil the whole work.

While it is sometimes necessary to use glue in putting holly work together, it is better, when possible, to use fine screws; but when glue must be used, the whitest kind should be employed. Unless the sawyer is a pretty good hand at cutting, he should not undertake to make intricate work in holly, but if the operator is certain he can finish what he undertakes, then we say "go ahead;" but he should not tire himself the first day, or work hard for a week and then drop off for six months. It is best to "make haste slowly" and persistently until the work in hand is fully completed.

Holly grows plentifully in South America, mostly in swampy situations; also in Nepaul, Japan, and some other parts of the world. The name holly is said to be derived from the use of the branches and berries to decorate churches at Christmas, from which the tree was called Holy tree.

Black walnut is an excellent wood for the sawyer, and always looks best when about one-quarter of an inch thick. It works easily, is not liable to chip, is cheap, easily polished or oiled, and does not look dirty nearly so soon as many other woods. There are nearly thirty varieties of walnut known, mostly natives of America. It is also a native of Persia, India, some parts of Africa, and Europe. The Romans were well acquainted with it, and it was cultivated in forests as early as Tiberius. The walnut of our own country is the largest and handsomest of them all. Sometimes it reaches the enormous dimensions of six or seven feet in diameter at the trunk.

Oak or ash, when used by the sawyer, should never be less than three-eighths of an inch thick. These woods should be varnished, never oiled. They both darken with age, particularly oak, which soon assumes a fine dark color that gives it a rich and valuable appearance.

Novel Method of Exhibiting Native Woods in the Drawing Room.

BY F. B. BROCK.

DURING a recent visit to the National Museum at Washington, now in the course of being fitted up for the reception of curiosities and other things pertaining to a museum, I was much interested in a collection of ornamental woods from Japan—a gift from the University of Tokio. This collection embodies so much originality and attractiveness combined, with simplicity in the manner of its exhibition, that I cannot refrain writing you on the subject in the hope that some who read this, and whose accomplishments are such as to permit them to indulge the art, may be enabled to beautify their homes without any expense, other than loss of time.

This Japanese collection consists of a series of panel frames 8 x 12 inches each, a panel being devoted to each variety of wood. The general appearance of the panel is shown by the subjoined sketch. The panel, A, proper is a thin planed surface ($\frac{1}{8}$ in. thick) and, in this collection, is unpolished, though it is obvious that a polish may be given to the wood. When the diameter of a tree is less than eight inches two or more pieces are laid side by side to give the requisite width. In the sketch here given the panel is in four pieces, the division lines being indicated in the drawing. The frame, B, of the panel is cut from the same wood, an inch in width by one-half inch in thickness. The face width of the frame, B, is left with the bark on, in order to show its formation, and it also forms a pleasing contrast to the panel. At the four corners of the frame are transverse sections, C, of the same species of wood of the same depth ($\frac{1}{2}$ in.) as the frame, B, and lying flush therewith. These sections, C, must be cut from a small limb of the tree, which should be approximately an inch and a half in diameter. Their faces should be sandpapered or polished.

The artistic preparation of the panel is next in order. It consists in painting, in oil or water colors, a twig and specimen leaves of the same tree from which the

framed panel has been made. If the tree flowers, as most of the ornamental trees do, the bud, the blossom, and the seed should be shown by detail views on the panel. Some trees, as the locust, bear seed pods, and these form pleasing subjects to put upon the panel. In case of fruit or nut-bearing trees, the specimen fruit and nut may be painted. Even the bugs or worms which infest the tree may appropriately appear.

The name and genus of the tree is provided for in the space marked D, which, in the sketch, is filled by Japanese characters.

In this manner it is possible for the owner of a rural home, with some experience in water or oil colors, to become possessed of beautiful panels of every kind of wood growing on his place and those out of it. They are appropriate for the drawing-room, and form unique and interesting subjects. In the museum they are grouped together in handsome cases, where they are much admired.—*Builder and Wood-Worker.*

Animal Intelligence.

A GREAT many very amusing and interesting stories are told of animals, birds and insects, some of which would lead us to suppose that the animals possessed an intelligence much higher than is usually attributed to instinct. Take, for instance, the conduct of the mason wasp, or carpenter bee, when building her nest. She has had no individual experience; the nest is her first effort, and she never survives to build another. She

never saw her parents, who must have perished before she issued from the egg. Her mate and any other of her own species whom she may have seen are exactly in the some position as herself, yet she proceeds with all due dignity, and constructs her nest with a regularity and completeness that is amazing. The mother first cuts a canal of suitable dimensions in a log of timber, especially when partly decayed; she then lays an egg at the end of the hole, and places near it a mass of pollen and honey, as food for the future larva. The egg and the food are then sealed up by a thin wall, made up of powdered wood and a secretion of the insect. In this manner the mother bee divides her house into little chambers, depositing an egg in each one. In due time the eggs hatch, and the larvæ devours the food left for them, and then pass into the chrysalis state. When the perfect insect is developed, it destroys the partitions and escapes into the open air, and proceeds to construct its nest, just the same as its mother did before it. Now how do these bees acquire the knowledge to construct their nests? This is a question that offers food for the advanced thinker.

Another curious thing is noticeable in the case of young pointer dogs, which goes to show that a peculiarity, not originally possessed by the breed, can be, and is, hereditarily transmitted to the exclusion of an instinctive quality.* These dogs, though they may never have had any previous training, when taken into a stubble field for the first time, act as though they had been taught to point at birds, as their parents had before them, but whose actions they had never seen, and whose natural instincts would lead them to rush at any small birds or beasts that might make their appearance. Here we have one instance where education or training is handed down from one generation to another.

According to a quotation made from an unpublished M.S. of the late Charles Darwin, "even the headless oyster seems to profit by experience. Disquemose records that 'oysters taken from a depth never uncovered by the sea open their shells, lose the water within, and perish; but oysters from the same place and depth, if kept in reservoirs, where they are occasionally left uncovered for a short time, and are otherwise incommoded, learn to keep their shells shut, and then live for a much longer time when taken out of the water.'" According to Bingley, this fact is turned to a practical account in the "oyster schools" of France: "The distance from the coast to Paris being too great for the newly-dragged oysters to travel without opening their shells, they are first taught in the schools to bear a longer exposure to the air without gaping, and when their education is complete, they are sent on to the metropolis, where they arrive with closed shells and in a healthy condition." Here we have an intelligence evinced by an animal of very low organization, for it is evident the oyster can modify its actions according to circumstances, so as to avoid inconvenience.

In ants we find a very high grade of mental power, and there is a superabundance of evidence that they possess fair memories. "It is well known that if a strange ant, even of their own species, is introduced into a nest, it is, as a rule, attacked at once and killed without mercy. But if some of the inmates of a nest are removed, and kept apart from their fellows, even for months, they are at once recognized when brought back to the community. It is an important fact that this recognition is not automatically invariable. When ants are removed in the pupa state, tended by strangers, and then restored, some, at least, of their relations, are certainly puzzled, and in many cases doubt their citizenship. We say some, because, while strangers under the circumstances would have been imimmediately attacked, these ants are in every case amicably received by a majority of the colony, and sometimes it takes several hours before they come across any one who does not recognize them."

As to the memory of ants for direction and locality, many of the observations

*From "Animal Intelligence." By G. J. Romanes, F.R.S.

are open to doubt, as the rediscovery of an abandoned nest, may be accidental, as in a case mentioned by Belt. But Carl Vogt, in his "Thierstauten," mentions that "for several successive years ants from a certain nest used to go through several inhabited nests to a chemist's shop 600 yards distant, in order to obtain access to a vessel filled with syrup." This was continued for several seasons, thus showing that the ants remembered the syrup jar from year to year.

As a proof that ants have some means of communication among themselves, we have but to describe the experiment performed by Sir J. Lubbock: Three glasses were connected with a nest of black ants by means of three tapes, equal in length and width, and placed parallel with each other, so that the means of access from the nest to each glass were exactly equal. In one of the glasses were placed from three hundred to six hundred larvæ, in the second two or three only, and in the third none at all. The object of the last was to see whether any ants would arrive at the glasses by mere accident. The experimentalist then put a mature ant into each glass. Each of them took a larva and carried it to the nest, returning for another, and so on. After each journey another larva was put in the glass containing only a few larvæ. Sir J. Lubbock reasoned that if the ants came to the glasses as a matter of accident, or accompanied one another by chance, or if they merely saw larvæ being brought, and concluded that more might be found in the same place, or if the ants were merely guided by the scented track of their forerunners, the number of the ants going to each of the two glasses ought to be approximately equal. But this was not the case. To the glass containing many larvæ there came, in 47½ hours, 257 ants; to that with only two or three larvæ there came in a time longer by 5½ hours, only 82 ants; and to the glass containing no larvæ there came not one. Hence it is concluded that ants can not only tell their companions that work is to be done, but can give some idea of its quantity, and of the number of hands required for its performance. The precaution taken by Sir J. Lubbock, will, on careful consideration be found to exclude every other interpretation of the facts.

A Mr. H. L. Jenkins tells the following: "There are good reasons for supposing that elephants possess abstract ideas; for instance, I think it impossible to doubt that they acquire through their own experience notions of hardness and weight. The grounds on which I am led to think thus are as follows: A captured elephant, after he has been taught his ordinary duty, is taught to pick up things from the ground and give them to his mahout sitting upon his shoulders. For the first few months it is dangerous to require him to pick up anything but soft articles, because the things are often handed up with considerable force. After a time they appear to take in a knowledge of the nature of the things they are required to lift, and a bundle of cloths will be thrown sharply as before, but heavy things, such as a crowbar or iron chain, will be handed up in a gentle manner; a sharp knife will be picked up by the handle and placed on the elephant's head, so that the mahout can also take it by the handle. I have purposely given elephants things to lift which they could never have seen before, and they were handled in such a manner as to convince me that they recognized such qualities as hardness, sharpness, and weight."

Mr. Peal observed a young recently captured elephant, in Assam, pulling up and breaking some bamboo stakes, and carefully examining the pieces. "At last it seized one firmly in its trunk, and advancing its left foreleg firmly, passed the fragment of bamboo under the arm-pit, and began to scratch with some force. A large elephant leech soon fell to the ground, which, from its position, could not easily be detatched without this scraper, which had been deliberately made by the elephant." The narrator very truly says that these scrapers are *bona fide* tools, "intelligently made for a definite purpose." Here we have an instance of an animal making and using tools to accomplish an end that would otherwise have been left undone.

Fish Ponds.

To the formation of a fish pond a springy piece of ground, a large creek, or a small one, or any combination which will furnish a constant supply of fresh water, is a prerequisite.

By attaching a pump, propelled by the wind, to a well, you can supply a basin from fifty to seventy-five feet in diameter and six to eight feet deep, with water sufficient to raise several thousand carp, or other fish. The cost of this pond and appurtenances need not exceed fifty dollars, but excavations can be made to any extent to suit the taste or means of the owner. The dirt from these excavations should be removed far enough not to be washed back by rains. The bottom and sides need to be cemented or thoroughly puddled—that is made of good clear clay, moistened and well beaten. This will prevent the loss of water by leakage. When the basin is complete, place in it a small quantity of brush or floating weeds. A few trunks of trees, secured to the bottom, will afford a suitable hiding place for the fish, and will prevent marauders stealing the fish by netting. An outlet as well as an inlet for water should be provided, and proper screens be arranged so as to prevent the escape of fish. If you intend to raise carp, do not place other fish of a predatory character in the pond. The spawning will occur during the spring months, the female laying from 50,000 to 500,000 eggs. The eggs will adhere to whatever they touch, and will soon hatch. The green scum of a partially stagnant pond is fine food for the young fish. Mud in the bottom of the pond is beneficial. The fish will feed readily on kitchen-garden refuse, such as cabbage, leek, lettuce, hominy, or other substances.

Water seldom becomes too warm for these fish. During freezing weather, they bury themselves in the mud at the bottom of the pond. While in this condition, they should not be disturbed. In a pond of the given dimensions, several thousand fish have annually been taken. If weeds and grass grow profusely about the borders of the pond, so much the better for the fish. In two years time you can have an abundant and constant supply of sport and food, and the advantage of a pond, to assist in beautifying your home.

Col. Akers, the fish commissioner, of Tennessee, while visiting the pond of Messrs. Sprewitt & Co., captured a carp weighing over a pound and a half, and said the sport was as good and exciting as he wanted.

The kind of fish to stock the ponds with depends upon circumstances. If the pond is fed with abundant living springs and streams, if the water can always be kept clear and cool, trout are undoubtedly the best fish to obtain, in which case the bottom should be covered with coarse gravel or small stones, though this is by no means necessary.

How Closely Does a Machinist Measure?

In connection with the question of standard gauges and measuring instruments of perfection, it is interesting to notice how closely the machinist works with the *ordinary* tools of his trade.

Some little observation of a workman engaged in boring locomotive driving wheels and fitting shafts to them, led to to the following;

The wheels were bored with a tool, and of a taper of 1.64 inch in 7 inches. They were bored in a remarkably good lathe. but not to *exactly* the same size. A certain distance was fixed upon as proper for the wheel to be forced on the shaft, after allowing the shaft to settle into the wheel (which was laid down on the floor) by its own weight, and the workman would not make a variation of more than ⅛ inch in that distance.

Making allowance for want of truth in the hole and shaft (although it was extremely difficult to detect any variation), it is safe to say that the machinist was working within 1-4000th of an inch. To do this, he must first measure the hole in the wheel with his caliper, transfer that measure to another pair of calipers, and again transfer that measure to the shaft he was turning. Making allowance for the fact that a machinist cannot turn as fine as he can measure, it may be safely concluded that he will work so closely, that the variation will be scarcely noticeable in a fit. However closely he may work, the fact should not be lost sight of, that he cannot define the size to which he is working, without the use of some sort of a measuring instrument of perfection. In other words, he can work almost infinitely closer than he can measure, by the use of ordinary tools.—*American Machinist.*

Marvels of Pond Life.—XV.

THE creatures described in the preceding articles range from very simple to highly complicated forms, and in describing them some attention has been paid to the general principles of classification. The step is a wide one from the little masses of living jelly that constitute Amœbæ to the Rotifers, supplied with organs of sensation—eyes, feelers (calcars), and the long cilia in the Flosculariaus which seem to convey impression like the whiskers of a cat—together with elaborate machinery for catching, grinding up, and digesting their prey, and which are also well furnished with respiratory and excretory apparatus, ovaries, etc. In the polypi and polyzoa may be observed those resemblances in appearance which induced early naturalists to group them together, and also the wide difference of organization which marks the higher rank to which the latter have attained. Amongst the ciliated infusoria important gradations and differences will also be noticed, some having only one sort of cilia, others two sorts, and others, again, supplied, in addition to cilia, with hooks and styles. No perfectly satisfactory classification of the infusoria has yet been devised, and the life history of a great many is still very imperfectly known. On the whole, the tendency of research is to place many of them higher than they used to stand after Ehrenberg's supposition of their having a plurality of distinct stomachs, etc., was given up. Balbiani and others have shown numerous cases of their forming their eggs by a process analogous to that of higher animals. Some really are, and others closely resemble, the larval conditions of creatures higher in the scale, and the contracted vesicle with its channel bears resemblance to what is called the "water vascular system " of worms.

Zoological classification depends very much on morphology, that is, the tracing of particular structures, or parts, through all their stages, from the lowest to the highest forms in which they are exhibited. In this way the swimming bladder of a fish is shown to be a rudimentary lung, though it has no respiratory functions, and Mr. Kitchen Parker has found in the imperfect skull of the tadpole a rudimentary appearance of bones belonging to the human ear. The comparative anatomist, after a wide survey of the objects before him, arranges them in groups. He asks what are the characteristic things to be affirmed concerning all the A's that cannot be said of all the B's; or of all the C's that marks their difference from the A's or the D's. Careful investigation upon these methods shows affinities where they were not previously expected—birds and reptiles being close relations, for example, instead of distant connections—and they lessen the value for purposes of classification of peculiarities that might have been of the highest importance.

Professor Huxley divides the vertebrates into ITHYCOIDS, comprising fishes and amphibia, which besides other characteristics, have gills at some period of their existence; SAUROIDS (reptiles and birds), which have no gills. and possess certain developmental characteristics in common; and, lastly, MAMMALS. The Insecta, Myriopoda, Arachnidæ, and Crustacea, he remarks, "without doubt present so many characters in common as to form a very natural assemblage. All are provided with artificial limbs attached to a segmented body skeleton, the latter, like the skeleton of the limbs, being an 'exoskeleton,' or a bordering of that layer which corresponds with the outer part of the vertebrates. In others, at any rate in the embryonic condition, the nervous system is composed of a double chain of ganglia, united by longitudinal commissures, and the gullet passed between two of these commissures. No one of the members of these four classes is known to possess vibratile cilia. The great majority of these animals have a distinct heart, provided with valvular apertures, which are in communication with a perivisceral cavity containing corpusculated blood." These four classes have constituted the larger group or "province" of *Articulata* or *Arthropoda*. Professor Huxley thinks that, notwithstanding "the marked differences " between the Annelida (worms) and the preceding Arthropods (joints-foots), their resemblances outweighing them—the characters of the nervous system, and the frequently segmented body, with imperfect lateral appendages of the Annelida necessitates their assemblage with the Arthropoda in one great division, or sub-kingdom, of ANNULOSA.

Tracing analogies between Echinodermata (sea urchins, star-fish, etc.) and the Scolecida (intestinal worms), he places them together as *Annuloida*.

Cephalopoda, Pteropoda, Pulmo-gasteropoda, and Branchio-gasteropoda, having resemblances of nervous system, and "all possessing that remarkable buccal apparatus, the Odontophore," are placed together by him as ODONTOPHORA. The Odontophores (tooth-bearers) are familiar to microscopists as the so-called *palates* of mollusca. Placing with the above the lamellibranchial mollusks (mollusks with gills formed of lamellæ or little plates), Ascidioida (ascidians,) Brachiopoda (lampsheds), and Polyzoa, in spite of their differences, he forms another great group, ANNULOIDA.

The Actinozoa (anemones, etc.) and the Hydrozoa (polyps) constitute the CŒLENTERA of Frey and Leuckart. "In all these animals," says Professor Huxley, "the substance of the body is differentiated into those histological elements which have been termed cells, and the latter are previously disposed in two layers, one external and one internal, constituting the ectoderm and endoderm. Among animals which possess this histological structure the Cœlenterata stand alone in having an alimentary canal, which is open at its inner end and communicates freely by this aperture with the general cavity of the body," and "all (unless the Ctenophora should prove a partial exception to the rule) are provided with very remarkable organs of offence or defence, called thread-cells or nematocysts." In describing the Polyps we have given illustrations of these weapons.

The remaining classes, which have been roughly associated as *Protozoa*, must evidently be rearranged. Sponges, Rhizopods (Amœbæ, etc.), and Gregarines, have strong resemblances, but recent researches may place the former higher. The Infusoria comprehend creatures too various to remain under one head, and very many of them too highly organized to be called "protozoons," or first life-forms.

Those who wish to pursue this subject further may consult Professor Huxley's 'Elements of Comparative Anatomy,' from which the preceding quotations have been taken.

A system of classification founded upon anatomical and developmental considerations frequently differ considerably from one we might arrive at if all the creatures were arranged according to their faculties and the extent and accuracy of their relations to the external world. Such a classification would not in any way supersede the former, but it would prove very instructive and offer many valuable suggestions. Some years since, Professor Owen proposed to divide the Vertebrates according to the perfection of their brains, but other anatomists did not find his divisions sufficiently coincident with facts. Very little has been done towards an exact science of human phrenology. The difficulties remain pretty much as they were many years ago, and our comparative phrenology, if we may use such a term, is in a very imperfect state. When we come to the lower animals we do not know what peculiarities of the brain of an ant make it the recipient of a higher instinct, or give its possessor greater capacities for dealing with new and unexpected difficulties than are possessed by most other insects, and if any reader has a marine aquarium, and will make a few experiments in taming prawns, and watching their proceedings, he will discover symptoms of intelligence beyond what the structure of the creature would have led him to expect.

Animals usually possess some one leading characteristic to which their general structure is subordinated. Man stands alone in having the whole of his organization conformed to the demands of a thinking, ruling brain. To pass at once to the other extreme, we observe in the lower infusoria a restless locomotion, probably subservient to respiration, but utterly inconsistent with a well developed life of relation, or with manifestations of thought. The life of an animalcule may be summed up as a brief and restricted, but vigorous organic energy, and if the amount of change which a single creature can make in the external world, is inconceivably small, the labors of the entire race alter the conditions of a prodigious amount of matter. Microscopic vegetable life is an important agent in purifying water from the taint of decomposing organisms. By evolving oxygen it brings putrescent particles under the influence of a specific combustion, which, though slow, is as effectual as that which a furnace could accomplish. In this way minute moulds burn up decaying wood.

Microscopic animal life helps the regenerative process, and, together with the minute vegetable life, restores to the organic system myriads of tons of matter, which death and decay would have handed over to the inorganic world. In a very small pond or tank the quantity of this kind of work is soon appreciable, and if we reflect on the amazing amount of water all over the globe, including seas and oceans, which swarm with infusoria, the total effect produced in a single year must seem considerable, even when compared with that portion of the earth's crust that is subject to alteration from all other causes put together. If we add to the labor of the Infusoria those of other creatures whose organization can only be discovered by the microscope, and take in the foraminifera, polyps, polyzoa, etc., we shall have to record still larger obligations to minute forms of living things. The coral polyp builds reefs that constitute the chief characteristic of certain regions in the Pacific; foraminifera are forming or helping to form strata of considerable extent, while diatoms are making deposits many feet in thickness, composed of myriads of their silicious shells, or adding their contributions of silex, very large in the aggregate, to all sedimentary rocks. Testimony of this kind of work is found by the navigator who examines the ice in Arctic seas, and it comes up with soundings from the ocean depths.

On the surface of the earth the amount

of change produced is equally remarkable, although it leaves less permanent traces behind. As a rule no decomposition of organized matter takes place, no death of plants or animals, without infusorial life making its appearance, and disposing of no small portion of the spoils. Even in our climate the mass of matter thus annually affected is very large; but what must it not be in moist tropical lands, where every particle seems alive, and the race of life and death goes on at a speed, and to an extent scarcely conceivable by those who have not witnessed it.

Thus, if we look at the world of minute forms which the microscope reveals, there opens before us a spectacle of boundless extent. We see life manifested by the specks of jelly containing particles not aggregated into structure, and we see it gradually ascending in complexity of organization. In creatures whose habits and appearance seem most remote from our own, we find the elementary developments of the organs and powers that constitute our glory, and give us our power. Such studies assist us to conceive of the universe as a Cosmos, or Beautifully Organized Whole; and, although we cannot tell the object for which a single portion received its precise form, we trace everywhere relations of structure to means of existence and enjoyment, and are led to the conviction that all the actions and arrangements of the organic or inorganic worlds are due to a definite direction and co-ordination of a few simple forces, which implicitly and unerringly obey the dictates of an Omniscient Mind.

Simple Veneering with the Hammer.

THE following directions for veneering, if strictly followed, will insure success in this important branch of mechanical work.

The softest woods should be chosen. Perhaps the best for the purpose are those of perfectly straight grain and without a knot; of course don't attempt to veneer over a knot. Hard wood can be veneered, boxwood with ivory for instance, but wood that will warp and twist, such as cross-grained mahogany, must be avoided. The veneer and the wood on which it is to be laid must both be carefully prepared, the former by taking out all marks of the saw on both sides with a fine toothing plane, the latter with a coarser toothing plane. If the veneer happens to be broken in doing this, it may be repaired at once with a bit of stiff paper, glued upon it on the upper side. The veneer should be cut rather larger than the surface to be covered; if much twisted it may be damped and placed under a board and weight over night. This saves some trouble, but with veneers that are cheap it is not worth while taking much trouble about refractory pieces.

The wood to be veneered must now be sized with glue. The ordinary glue-pot will supply this by dipping the brush first into the glue, then into the boiling water in the outer vessel. This size must be allowed to dry before the veneer is laid on. We will suppose now that the veneering process is about to commence; the glue in good condition and boiling hot, the bench cleared, a basin of hot water with the veneering hammer and a sponge in it, a cloth or two, and everything in position that one will not interfere with, or be in the way of another.

First damp with hot water that side of the veneer which is not to be glued, then glue the other side. Secondly, go over as quickly as possible the wood itself, previously toothed and sized. Thirdly, bring the veneer rapidly to it with the outspread hands, and taking care that the edges of the veneer overlap a little all round. Fourthly, grasp the veneering hammer close to the pene (shaking off the hot water from it) and the handle pointing away from you. Wriggle it about, pressing the veneer down stoutly, and squeezing the glue from the middle out at the edges. If it is a large piece of stuff which is to be veneered, the assistance of a hot iron will be wanted to make the glue liquid again after it has set; but do not let it dry the wood underneath it, or it will burn the glue and scorch the veneer, ruining the work. Fifthly, having got out all the glue possible, search the surface for blisters, which will at once be betrayed by the sound they give when tapped with the handle of the hammer: the hot iron must be applied, or the inner vessel of the glue-pot itself, which often answers the purpose, and the process with the hammer repeated. When the hammer is not in the hand, it should be in the hot water. The whole may now be sponged over with hot water, and wiped as dry as can be. And observe, throughout the above process, never have any slop and wet about the work that you can avoid. Whenever you use the sponge, squeeze it well first. Damp and heat are wanted, not wet and heat. It is a good thing to have the sponge in the left hand nearly all the time, ready to take up any moisture or squeezed out glue from the front of the hammer.

So much for laying veneers with the hammer, which, though a valuable tool, is not much used in the best cabinet-makers' shops, cauls being adopted instead. Cauls are made of wood, the shape and size of the surface to be veneered, or better still, of rolled zinc plate, and being made very hot before a good blaze of shavings, they are clamped down on the

work when the veneer is got in its place. The cauls must previously be soaped, to prevent them sticking to the veneer. The whole is then left to dry together. The hammer is quite sufficient, however, in small cabinet shops, and for amateurs, who will not require to cover surfaces of any great extent. Veneers 5 feet long and 18 inches wide can be laid with the hammer, without assistance, and without leaving a blister. Cauls, however, are very necessary if a double-curved surface has to be veneered, or a concave surface; they need not be used for a simple convex surface. By well wetting one side of the veneer, it will curl up, and can be easily laid on such a surface; but it will be well to bind the whole round with some soft string, to assist in keeping it down while drying.

Our New Departure.

IN response to a very large number of requests, we have decided to greatly enlarge the YOUNG SCIENTIST. This change will take place with the issue for January 1883, and of course the price will at the same time be increased. We have fixed upon one dollar as the future yearly subscription to the YOUNG SCIENTIST, and from the many letters in our possession we feel sure that our new departure will give general satisfaction. The journal will be enlarged to nearly three times its present size, and of course the expense will be greatly increased, but this general advancement means to our readers something more than a mere change in size and price. It means greater variety and scope in the topics selected for discussion in the journal; it means greater thoroughness in working them out; it means more illustrations; it means greater regularity and promptness, and, finally, it means such an organization as will bring the YOUNG SCIENTIST close to every one of its seven thousand readers.

With the price at fifty cents, the manager of the YOUNG SCIENTIST was obliged to be editor, publisher, reporter, etc., etc., all rolled into one. With the higher price and more extended circulation, the YOUNG SCIENTIST will have a special editor with whose special duties no other calls shall be allowed to interfere, and in addition to this the staff of contributors and occasional writers will be largely increased. At the same time the former editor will lose none of his interest or influence; the YOUNG SCIENTIST will still be what it always has been, the representative of the Amateur Scientist and Mechanic. But with relief from the burden of minute detail comes greater opportunity to accomplish more important things, and maintain more thoroughly the more important departments.

With the January number, Mr. Fred. T. Hodgson, whose name is familiar to every reader of the YOUNG SCIENTIST, will join us in our editorial work. If you desire to see the results, just send on your subscription for 1883, or send by postal card a request for the January number.

BOOK NOTICES.

How to be Weather-Wise. A New View of Our Weather System. With Illustrations. By Isaac P. Noyes. 12mo., pp. 51, price 25 cents. Fowler & Wells, Publishers, 753 Broadway, New York.

The methods and operations of our weather bureau form one of the most wonderful results of modern science. If we take the state of practical meteorology at the time that Kæmitz wrote his work—barely half a century ago—and compare it with the results at present within the reach of scientific men, we shall obtain one of the most striking illustrations of the interdependence of the arts and sciences. No one of them grows without lifting all the others up with it. Our modern weather bureau is the outgrowth not only of an improved science of meteorology but of our extended system of telegraphy. Without the latter the former would be impossible. The work before us gives a very fair view of the working of this system, but we think the title is rather misleading. Any one who expects to learn from its pages how to forecast the weather will, we think, be disappointed. At the same time no one can read it carefully without gleaning much useful and interesting information.

Keely Outdone.

The following, which we clip from an exchange, beats Keely out of sight: "A Rochester gentleman proposes to furnish power to run the whole world, so to speak, but more particularly the ocean steamers and ships of all kinds, railroad trains, factories, etc. Like the other inventors, he proposes to get his power very cheap—in fact, for nothing. His idea is to construct a turbine wheel nearly one mile in diameter, with all the modern improvements. This wheel he intends to have placed in the great

maelstrom off the coast of Norway, attaching to it cables which shall span the oceans, and which, when the wheel once starts in motion, as it is, of course, sure to do in this wonderful current, will furnish power for everybody. All the expenses attached to this will be repairs to the wheel and the cables which may occur from time to time, 'And,' said the inventor to a reporter, 'you know that will amount to almost nothing.'"

Photographs that Wink.

The last new thing in photography surpasses the ingenuity of the man who invented the spirit photographs, and suggests how handy it would have been had that crafty person added this to his devices. A Frenchman takes one negative of a sitter with open eyes. Then he makes the sitter shut his eyes and remain in exactly the same position while another negative is taken. The two negatives are printed on the same paper, one on each side exactly coinciding. When this double-faced picture is held in proper position before a lamp, and the lamp is rapidly moved or caused to flicker, the curious effect is produced of long-continued winking. It is not claimed that a person looks more beautiful when he keeps winking, but it cannot be denied that it gives one a very interesting appearance.

Reversing the Wheels.

Experiments lately made at Blackburn with a train made up in imitation of that of the express which ran into the train standing in Blackburn station, to test the statement of the driver that he reversed his engine as soon as he found the brakes did not check his train, are of some interest, though they elicited the fact that the reversal of the engine of a train running at a high velocity has but a very small effect in reducing the speed. A high speed was attained, and the engine was reversed a quarter of a mile before reaching the station, but the train ran through the station at about 20 miles an hour, and had to be stopped by the brakes. Locomotive driving wheels, when running the reverse way, are not effective in stopping a train. The experiment shows how little can be gained by reversing an engine under such circumstances.

Practical Hints.

The Victoria Regia.—Mr. E. D. Sturtevant, a florist of Bordentown, N. J., has accomplished a feat hitherto unknown in the annals of floriculture in this country, that of growing to perfection in the open air a plant of the famous victoria regia, the giant water lily of South America. The plant now has leaves six feet in diameter, and has unfolded its first flower, which was the admiration of all beholders. Mr. Sturtevant's plant will continue to bloom for several weeks.

Rendering Tissues Waterproof.—Prepare the two following solutions: 2 lb. 8 oz. paraffine dissolved in 10 lb. tar-benzine, and 8 oz. caoutchouc dissolved in 5 lb. tar-benzine. The two solutions are well mixed together before using, and 8 oz. linseed oil varnish is added to the mixture. This mixture is spread cold on the tissue by means of a brush once on each side of the cloth.

Preservation of the Colors of Dried Plants.—According to M. Storbzl, the slow immersion of the fresh plant in a boiling solution of one part of salicylic acid in 600 parts of alcohol, and then shaking off superfluous moisture, previous to pressing in the usual way between blotting-paper, will more nearly preserve the natural color than any other method.

Metrical Abbreviations.—The following abbreviations for metrical units have recently been decreed by the Spanish Government for Spain and its colonies:

Kilometer	km.	Cubic decimeter	dm^3.
Meter	m.	Cubic centimeter	cm^3.
Decimeter	dm.	Cubic millimeter	mm^3.
Centimeter	cm.	Hectoliter	hl.
Millimeter	mm.	Decaliter	dal.
1-1000 millimeter, or micro-millimeter	mmm.	Liter	l.
Square kilometer	km^2.	Deciliter	dl.
Hectare	ha.	Centiliter	cl.
Are	a.	Ton	t.
Square meter	m^2.	Metrical cwt	q.
Square decimeter	dm^2.	Kilogram	kg.
Square centimeter	cm^2.	Gramme	g.
Square millimeter	mm^2.	Decigramme	dg.
Stere	S.	Centigramme	cg.
Cubic meter	m^3.	Milligramme	mg.

Silvering Iron.—A manufacturer in Vienna employs the following process for silvering iron: He first covers the iron with mercury, and silvers by the galvanic process. By heating to 300° C., the mercury evaporates and the silver layer is fixed. Ironware is first heated with diluted hydrochloric acid, and then dipped in a solution of nitrate of mercury, being, at the same time, in communication with the zinc pole of an electric battery, a piece of gas carbon or platinum being used as an anode for the other pole. The metal is soon covered with a layer of quicksilver; is then taken out and well washed and silvered in a silver solution. To save silver the ware can be first covered with a thin layer of tin; one part of cream of tartar is dissolved in eight parts of boiling water, and one or more tin anodes are joined with the carbon pole of a Bunsen element. The zinc pole communicates with a well-cleaned piece of copper, and the battery is made to act till enough tin has deposited on the copper, when this is taken out and the ironware put in its place. The ware thus covered with tin, chemically pure and silvered, is much cheaper than any other silvered metals.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business matter in letters or cards they are filed away and never reach the printer.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, wher we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

I have a large assortment of foreign stamps to exchange, also Confederate money. Collectors send sheet and I will return it with mine. Box No. 2, Coeymans, N. Y.

Electric bell engine, cost $15; pair of analytical scales, cost $10; pair of Bell Telephones to exchange for a printing press, watch or offers. Geo. N. Bigelow, Box 754, Palmyra, N. Y.

To exchange for offers first four (fifth when completed) bound volumes of YOUNG SCIENTIST. J. N. Brooks, P.O. 1468, N. Y. City.

Any person wishing to trade bird's eggs may apply to me and I will send them my list of bird's eggs. I have only a few at present, but am receiving a number every month. A. G. G., Box 26, Summit, New Jersey.

Minerals of Idaho for Standard Works on the Horse—Wallace's Registers and turf journals. Wanted, also other useful books, bound and in good condition. Many varieties named in my list. J. P. Clough, Junction Lemhi Co., Idaho.

Wanted engraver's tools with book of instructions, for a Victor Press, with cabinet, 2 type cases, type, ink roller and furniture complete; perfectly new. L. Warren, 72 Cumberland St., Brooklyn, N. Y.

A Fletcher Foot-Blower, cost $5, as good as new; will exchange for a Cushman, 2 in. or up scroll chuck, or other make; will give a satisfactory trade on the difference in price, if any. Louis Lutz, St. Clair Street, Toledo, O.

I have a lot of "Galaxy" (magazines) which I would like to exchange for an air rifle in good condition, a collection of birds' eggs, or offers. W. B. Greenleaf, 480 La Salle Ave., Chicago, Ill.

I have a Mechanical Telegraph with book of instructions, books, etc., which I wish to exchange for good microscopical objects, mounted on 3 x 1 slips. Address, with list, J. H. Frey, Millersburg, Ohio.

To exchange, "How to Use Microscope," Wells' "Natural Philosophy," and many other books, chemical apparatus, etc , for good photographic camera, and lenses. W. H. Weed, 254 Putnam Ave., Brooklyn, N. Y.

Wanted "Quimby's New Bee Keeping," for "Our Own Birds of the United States," by W. S. Baily; new. Joseph Anthony, Jr., Colota, Whiteside Co., Ill.

Wanted a good book in anatomy, in exchange for a book on chemistry, or for story books. A. G. G., Box 26, Summit, New Jersey.

A German-silver trimmed, patent lined, cocoa flute, cost $4, in good order, for good spy-glass, photo-material, or offers. Ewing McLean, Greencastle, Ind.

I have some fossil shells from the west bank of the Mississippi, to exchange for Indian relics. A. W. S., 187 E. 71st St., N. Y.

I have a magic lantern, Ruby pattern, nearly new, and 5 views; also "Our First Century," bound in leather, cost $7; state what is wanted in exchange. I. N. Spencer, Box. 217, So. Manchester, Conn.

First-class telegraph instrument and attachments, and "Wood's Botany," for bound volumes of periodicals, books, or offers. H. P. Albert, Anderson, Iowa.

Wanted a book on treatment and care of canary, also breeding of same; will give in exchange book named "Market Garden, Flower Garden and Bees," or 40 "Scientific Americans" or "Seaside Libraries;" want also old books. M. J. Mulvihill, Norwalk, Conn.

Coins, minerals, stamps, books, type, fishing tackle (very complete) and fish pole, bronze inkstand, etc., for coins, medals, stamps, war envelopes, old newspapers, and Continental, Colonial and Confederate currency. F. F. Fletcher, 103 Main St., St. Johnsburg, Vt.

Blow-pipe set (cost $10), large illustrated family Bible (cost $7.50), for Wood's Botany, Dana's Geology, or printing press and type. H. W. Noble, Box 134, South Dansville, N. Y.

Wanted, offers for fossil shells from the west coast of Africa. A. W. Seward, 187 E. 71st St.

I have a number of birds' eggs I should like to trade for other birds' eggs; send for list of trading eggs. A. G. G., Box 26, Summit, New Jersey.

For a microscope stand or offers, a 36-inch turning lathe (new) and a number of scientific books; send for list. A. Kendall, Somerville, Mass.

Wanted services of amateur printer with small office (or large), in exchange for an interest in a well-established weekly paper, good size. Eagle Office, Plymouth, N. H.

American Agriculturist microscope, new, cost $15, for amateur photographic apparatus, lever watch, 22 calibre breech-loading sporting rifle or magic lantern of equal value. Wm. A. Walker, Rockland, R. I.

I. T. Bell, Franklin, Pa., has back numbers of Scientific American, Forest and Stream, and Young Scientist, good flute, chessmen, books, etc., for good magic lantern, revolver, scarce coins, or offers.

A steel spring bracket-saw, 2 doz. saw blades, and about 1 doz. patterns for a good stylographic pen or offers; send postal before exchanging. Geo. Oakley, Rutherford, N. J.

A rosewood banjo, 11 inch head, 12 nuts, fully strung, together with lot of dime banjo music and instructions, for microscope, Webster's Unabridged, monkey, squirrel and cage, or offers. J. DeWitt Clark, P. O. Box 37, Brooklyn, N. Y.

For self-inking printing press and type, one Henry rifle, 16 shot, 44 cal., cost $40, in good order, or one double barrel shot gun, barrels London fine twist, or offers. J. B. Garrison, Belton, Bell Co., Texas.

What offers for "The Chefs D'Oeuvre D'Art, Paris Exhibition 1878," cost $16, good as new, bound; 1 large photo camera, complete, cost $95; Scientific American from 1859 to 1880, 4 vols. bound. D. Keesler, Stony Point, N. Y.

Sea shells of Atlantic coast, scientifically marked, for books, old or new magazines, Indian relics, natural history specimens, apparatus; anything. Wilfred Leon Miller, P. O. Box 392, Cape May, N. J.

A new 40 diameter microscope, corals, and minerals, for a stylographic pen, air gun, or offers. J. McBride, 54 Garley St., Chicago.

A dulcimer that cost $20, books and fossils, for a telescope, microscope, fossils, Indian relics, or offers. E. J. Votaw, Salem, Iowa.

A self-inking model press, 5 x 7½, cost $23; $90 worth of scroll-saw designs in lots to suit; Scientific American, 1880; Palliser's Useful Details, $3; for photo outfit or offers. C. H. Parker, Coldbrook Springs, Mass.

Telegraph key and sounder, Frank Leslie's Illustrated Magazines, mounted microscopic objects, natural curiosities, for bull's-eye condenser, photograph camera, Unabridged Webster Dictionary, or offers. W. T. Alan, Greenville, Mercer Co., Pa.

Large magic lantern, spectroscope, pantagraph, for enlarging drawings, rosewood writing desk, man's saddle, for microscope, photo outfit or offers. Thomas Walters, Bergen St., East of Brooklyn Ave., Brooklyn, N. Y.

Model card press, chase 3¼ x 5¼, with 4 fonts type, cases, etc., for good foot lathe. Mills Day, 2 Farmington Av., Hartford, Ct.

French microscope, inclines to any angle, delicate fine motion, neat upright case, cost $17.50, for scientific books; send list to W. Fitz, P.O. Box 2852, New York.

Wanted, Quinby's New Bee Keeping, for Our Own Birds of the United States, by W. S. Baily; new. Joseph Anthony, Jr., Coleta, Whiteside Co., Illinois.

One years' copy of Aldine, cost $5.50, and German accordion, with instructions how to use it, cost $5.00, for offers. Chas. Dempwolf, 86 Benson St., Paterson, N. J.

THE Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

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Some Notes on Bird Stuffing.

OUR younger readers are advised not to attempt bird stuffing unless some person is near them who has had some experience in the matter. Care must be taken, while using the knife, to avoid being cut. Be very careful while using the corrosive sublimate, and when the work is completed, wash your hands well with castile soap and soft water.

This method of stuffing will be found to give good satisfaction if strictly followed:

Note 1st.—In dissecting, three things only are necessary to ensure success; viz., a penknife, a hand not coarse and clumsy, and practice. In stuffing you require cotton, a needle and thread, a little stick, glass eyes, a solution of corrosive sublimate, and any kind of temporary box to hold the specimens. Wire is worse than useless, as it gives a stiff appearance to the object stuffed.

Note 2nd.—A very small proportion of the skull bone, say from the fore part of the eye to the bill, is to be left in, part of the wing bones, the jaw bones, and half of the thigh bones remain. Everything else, flesh, fat, eyes, bones, brain and tendons, are all to be taken away.

Note 3rd.—In taking off the skin from the body it will be well to keep in mind that you must try to shove in lieu of pulling it, lest you stretch it. Throughout the whole operation, as fast as you detach the skin from the body, you must put cotton immediately betwixt the body and it; this will prevent the plumage getting dirty.

Note 4th.—Let us now proceed to dissect a bird. Have close by you a little bottle of corrosive sublimate, also a little stick and a handful or two of cotton. Now fill the mouth and nostrils with cotton, and place it on your knee on its back, with its head pointed to your left shoulder. Take hold of the knife with your two first fingers and thumb, the edge upward; you must not keep the point of the knife perpendicular to the

body of the bird, because, were you to hold it so, you would cut the inner skin, and thus let the intestines out. To avoid this let your knife be parallel to the body, and then you can divide the outer skin with great ease.

Note 5th.—Begin on the bird below the breast bone and cut down the middle, quite to the vent. This done, put the bird in any convenient position, and separate the skin from the body, till you get at the middle joint of the thigh. Cut it through, and do nothing more there at present except introduce cotton all the way on that side, from the vent to the breast bone. Do exactly the same on the opposite side.

Note 6th.—Now place the bird perpendicular, its breast resting on your knee, with its back towards you. Separate the skin from the body on each side of the vent, and never mind at present the part at the vent to the root of the tail. Bend the tail gently down to the back, and while your finger and thumb are keeping down the detached parts of the skin on each side of the vent, cut quite across and deep, until you see the back bone near the oil gland at the root of the tail. Sever the back-bone at the joint and then you have all the root of the tail, together with the oil gland, dissected from the body. Apply plenty of cotton.

Note 7th.—After this, by shoving and cutting get the skin pushed up until you come to where the wing joints join the body. Apply cotton, and then cut this joint through, and do the same at the other wing; add cotton, and gently push the skin over the head, cut out the roots of the ears, and continue skinning till you reach the middle of the eye; cut the membrane quite through, otherwise you would tear the orbit of the eye.

Note 8th.—After this nothing difficult intervenes to prevent your arriving at the root of the bill; when this is effected cut away the body, leaving just a little bit of the skull; clean well the jaw bones, and touch the skull and corresponding parts with the solution. Now all that remains to be removed is the flesh on the middle joints of the wings, one bone of the thighs, and the fleshy root of the tail.

Note 9th.—Now fasten thread to the joints of each wing, and then tie them together, leaving exactly the same space betwixt them as your knowledge in anatomy informs you existed there when the bird was entire; hold the skin open with your finger and thumb, and apply the solution to every part of the inside. Neglect the head and neck at present, they will receive it afterwards.

Note 10th.—Now fill the body moderately with wool to prevent the feathers below the breast from being injured. You must recollect that half of the thigh, or in other words one joint of the thigh bone, has been cut away. Now, as this bone never moved perpendicular to the body, but on the contrary in an oblique direction, of course as soon as it is cut off the remaining part of the thigh and leg, having nothing now to support them obliquely, must naturally fall to their perpendicular. Hence the reason why the legs appear considerably too long. To correct this take your needle and thread, fasten the ends round the bone inside, then push the skin just opposite to it, and then tack up the thigh under the wings with several strong stitches. This will shorten the thigh, and render it quite capable of supporting the body without the aid of wire.

Note 11th.—Now is the time to put in the cotton for an artificial body, by means of the little stick, and then sew up the orifice you originally made, beginning at the vent. Lastly, dip your stick into the solution, and put it down the throat three or four times, in order that every part may receive it. When the head and neck are filled with cotton quite to your liking, close the bill, as in nature. Bring the feet together by a pin, and then run a thread through the knees, by which you may draw them to each other, as near as you may judge proper. Nothing now remains to be added but the eyes; adjust the orbit to them as in nature, and that requires no other fastener. After this, touch the bill, orbit, feet, and former oil gland at the root of the tail, with the solution, and then you have given to the bird everything necessary, except attitude and a proper degree of elasticity.

Note 12th.—Procure any common ordinary box, fill one end of it, about three-fourths up to the top, with cotton, forming a sloping plane. Make a moderate hollow to receive it, and place the bird in its right position. If you wish to elevate the wings do so, and support them with cotton. If you wish to have the tail expanded, reverse the order of the feathers, beginning from the two middle ones, and when dry place them in their true order, and the tail will preserve for ever the expansion you have given it. In three or four days the feet lose their natural elasticity, and the knees begin to stiffen. When you observe this, it is the time to give the legs any angle you wish, and to arrange the toes. When the bird is quite dry, pull the thread out of the knees, and take away the needle, and all is done.

Flying Machines.

TO be able to fly like a bird has always been an object of great desire to most men, and to-day there are hundreds of inventors, old and young, who are wasting their time and energies on flying machines. The visitors to the late fair of the American Institue might have seen a flying machine for which the inventor made the most extravagant claims, and yet to any person at all familiar with sound mechanical principles it was obvious that this machine never could be of the slightest utility.

There are two problems involved in the flying machine, and inventors are very apt to get confused in regard to them. First of all we have to provide means for supporting the machine in the air; and secondly, it is necessary to have some way of propelling the machine without regard to the direction of the aerial currents—that is to say, of the wind. Before the days of balloons, machines had been made to support themselves in the air by their own motion. The flying pigeon made by Archytas was a striking example of this, and in more modern times we have many instances where heavy bodies are supported by the resistance presented by the air to their motion. One of the most familiar of these is the "artificial pigeon" used by sportsmen. This consists of a piece of sheet iron formed into the shape of the screw of a steam vessel. It is placed on a spindle around which a cord is wound, and when this cord is rapidly drawn off the spindle and screw revolve with great speed, just as a humming top revolves when the cord is drawn off. The screw then rises to a great height in the air, and sometimes flies to a distance of sixty to one hundred yards. Our young friends who wish to try this experiment can easily make the apparatus out of a common spool and a piece of card. The card is cut to the form of a propeller screw and twisted in the same way. Two pins are driven into the end of the spool about an eighth of an inch from the hole and on opposite sides, and holes are made in the card so that it may be slipped on these pins and held fast while the string is being drawn off the spool. As soon as the string leaves the spool, however, the card becomes loose and flies off to a considerable distance.

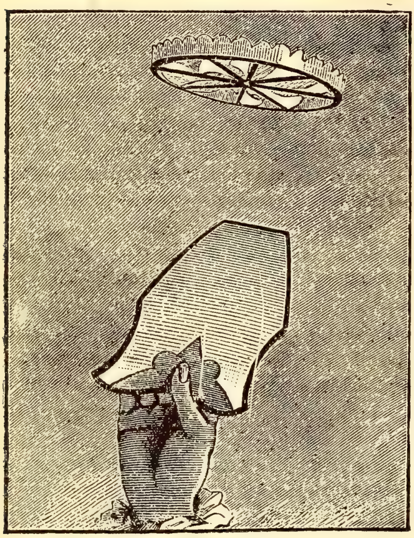
Another mode of showing the mechanical action of the air is as follows: Make a wheel with rim and spokes out of cardboard as shown in the figure. The card must be cut away so as to leave but very narrow spokes so that the air may have plenty of room to pass through. To each spoke is pasted a piece of stiff writing paper cut to the shape of a long triangle. The paper is then bent upwards so as to present a slanting face to the current.

When such a wheel is thrown into the air and fanned from beneath as shown in the figure, it will first be supported by the current from the fan, but as soon as this has produced a sufficiently rapid rotation the wheel will continue to mount of itself until it stops spinning. Such a wheel might be made to revolve by means of a spool fixed as we have just described, and then it would rise without any fan.

And older and more common than all these are the wings of birds, which show that weights of many pounds may be raised and transported through the air by mechanical means alone.

Thus far, however, all attempts to raise and propel a weight as great as that of an ordinary man by mechanical means have

failed, and neither the strength of human muscles, the power of steam or the force of more subtle agents, like electricity, have been found equal to the demand. But as soon as the balloon was invented it was seen at once that here was a means of supporting any required weight with



FLYING WHEEL.

safety and certainty, and the most extravagant hopes were entertained in regard to its ultimate success. It was seen at once, however, that this success was delusive, and that no balloon could ever be made a useful means of transport between any two given points, simply because its great bulk and the entire absence of any means of guiding it, left it at the mercy of the winds. The conditions under which a ship can be sailed within one or two points of the wind's eye are very different from those which obtain in the case of the balloon. In the case of the ship, while the sails are acted on by the wind, the hull, and especially the rudder, are immersed in a heavy liquid whose great resistance makes it easy to guide the ship. In the case of the balloon we have nothing of the kind; it is impossible to use a rudder with a balloon—attempts have therefore been made to steer the balloon by means of mechanical propellers, but without success. There has always been too much balloon and too little propeller.

Any one who will carefully study the subject in the light of sound mechanical principles will see that the only thing necessary to insure success for the flying machine is the invention of a motor of vastly greater power in proportion to its weight than anything we now have. As soon as this is invented flying will become a comparatively easy matter. But until that has been done, flying machines are an impossibility—just as locomotives and steamboats were an impossibility so long as the only steam engines were the ponderous affairs of Papin and Newcomen.

We have dwelt upon this subject because we know that it has a peculiar fascination for young minds, and many of our readers may devote themselves to the invention of a flying machine. We hope that before spending time and money on the subject they will carefully study the points we have discussed. In any case, from such study nothing but good can come.

Solomon and the Blacksmith.

THERE is a legend told of the wise king Solomon, which was recently republished in the *Blacksmith and Wheelwright*, that is interesting and instructive, and from which a moral may be drawn, as it shows how dependent the arts are on one another. We do not exactly agree with the idea intended to be conveyed by the story that the blacksmith is the "all-important," for it requires other arts than his to prepare the materials and appliances to work with; nevertheless, the story has a moral which our readers will easily discover:—

Among all mechanics the blacksmith undoubtedly has reason to be proud of his position, and in the recognition which history says he received at the hands of the wise king, there is applied the recognition which in one way or another, although seldom expressed, he received at the hands of modern mechanics. There is no trade or handicraft that is independent of the blacksmith, which fact lends additional interest to the following legend:

"1. And it came to pass, when Solomon, the son of David, had finished the Temple at Jerusalem, that he prepared a feast for his chief craftsmen and artificers, and spread the tables with the fatness of the land, and with the wine and corn and oil thereof.

2. And the seat of the king was apart on a raised dais, facing the head of the table, and the two famous pillars of bronze, with their beautiful capitals of lilies, pomegranates and delicate network, stood, one on his right hand and the other on his left, and the lintel thereof was a canopy over the head of the king.

3. And Solomon had also prepared a seat of honor, and set it on his right hand, ready for that craftsman who might be pronounced most worthy among all who wrought in building the house of the Lord.

4. And when all was ready he called unto him his chief architects and master-overseers, and the head artificers who were cunning workers in gold and silver, in bronze and ivory, and in wood and stone, yea, all who had labored in building the temple of the Most High, and he said unto them:

5. 'Come now with me and partake of the feast which I have prepared. Stretch forth your hands; eat, drink, and be merry. The skilled artificer is worthy of honor. Is not the laborer worthy of his hire? Muzzle not the ox that treadeth out the corn upon the threshing-floor.'

6. And when Solomon and his guests had arrived at the place of the feast, they beheld a man, clad in the garb and covered with the soil of labor, seated in the chair of honor not yet awarded. And the king waxed wroth, and said, 'What manner of man art thou? Why comest thou thus unseemly and unbidden to our feast, where none are invited save the chief workers on the temple?'

And the man answered and said, 'Please you, I came not unbidden. Was it not proclaimed that this day the chief workmen of the temple dine with the king? Therefore am I come.'

And when the man had thus spoken, the guests talked with each other, and he who carved the cherubim spake aloud and said: 'This fellow is no sculptor. I know him not.'

And he who inlaid the roof with pure gold said: 'Neither is he of those who work in refined metals.' And he who wrought in raising the walls said: 'He belongs not with those who are cutters of stone.'

And one who labored in shaping the timbers for the roof said: 'We, who are cunning in cedar wood, and know the mystery of joining strange timbers together, know him not; he is not of us.'

Then said King Solomon: 'How sayest thou now? Wherefore should I not have thee plucked by the beard, scourged with a scourge, and stoned with stones, even unto death?'

But the man was nowise daunted, and he rose from the seat, and came to where the wine was set, and took a cup of the wine and raised it high and spake aloud, saying, 'Oh, king! live forever!' He then drank long until the cup was emptied.

He now returned to the seat and spake to the guests who had rebuked him, and said unto the chief of the carvers in stone: 'Who made the instruments with which you carve?'

And he answered: 'The blacksmith.'

And to the chief of the workers in wood he said: 'Who made the tools with which you felled the cedars of Lebanon, and shaped them into pillars and roof for the temple?'

And he also answered: 'The blacksmith.'

Then he spake unto the artificer in gold and ivory and precious stones, saying: 'Who fashioned the instruments with which you wrought beautiful ornaments for my lord the king?'

And he, too, made answer the same: 'The blacksmith.'

Then said the man to Solomon: 'Behold, oh king! I am he whom, when men deride, they call blacksmith; but when they would honor me they call me Son of the Forge. These craftsmen say truly that I am not of them; I am their superior. Without *my* labor first, *their* labor could not be. The great Tubal Cain, whom all men honor, taught those who in turn taught me my handicraft, and the great

Vulcan, who wrought in fire and smoke and sweat, as I do, was it not deemed fitting that he should have even the Queen of Beauty to wife?'

'Son of the Forge,' said Solomon, 'I too honor thee, thou worthy successor of the great master, Tubal Cain. Take thou this seat at my right hand' prepared for the *most* worthy; it is thy due.'

Thus it came to pass at the feast of Solomon, the wise king of Israel, and from that time forth the smiths were held in high esteem, and greatly increased and multiplied in all lands."

Something About Scroll-Sawing.

WHEREVER there is a boy or girl in a house, the head of that house should provide for their use a serviceable scroll-saw. Indeed, the scroll-saw has become a necessity to every household; as much so, almost, as the family sewing machine, for of late years fret-sawing has become quite popular, and no boy of fourteen years of age is considered "up to the times" if he is not more or less expert in this fascinating art. This is quite natural; for the work is instructive, interesting and profitable, and but little practice is required to produce many ornamental, useful and really artistic articles for the decoration of the parlor and dining-room, such as brackets. screens, book shelves and racks, wall pockets, vases, easels, photograph frames, fancy boxes, clocks, inlaid panels, mottos and dozens of other things. The work, too, awakens an interest in drawing and designing, cultivates a love of art, and is therefore especially instructive to young people. It is also a source of amusement, and affords to young and old great delight as a pastime. It may also be made profitable, as many of the beautiful articles that can be made can readily be disposed of, or can be made for holiday and birthday gifts, and will be more valued by the recipients than articles for which a high price would have to be paid, thus saving to the giver a respectable sum. There is a pleasure, also, connected with this kind of work that is almost indescribable.

The work grows, as it were, under the hand of the operator. Church, bazaar, boudoir, parlor, or lodge-room, all may be beautified and made more attractive by this beautiful art. There is no scarcity of designs or patterns, even if the operator is not equal to do his own designing, as a superficial glance at any of the catalogues of patterns now offered by any of the dealers in amateur goods will show.

Fig 1.

Fig. 2.

The accompanying engravings are taken from Chas. E. Little's designs, and are neat, simple and effective. Fig. 1, "Welcome," is designed for a motto.

This looks very neat if cut from white holly, less than an eighth of an inch thick, and placed on a background of dark terra-cotta velvet, or fine cloth. When placed on a black background the contrast is too striking.

Fig. 2 shows another motto—one that is appropriate at this time of the year. The letters may be cut from thin mahogany or dark cherry, and nicely glued on light

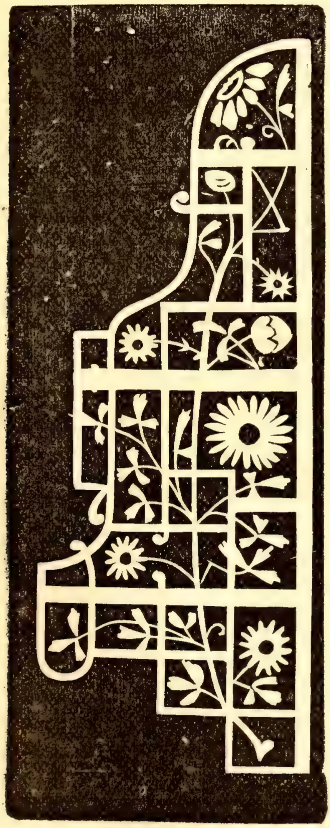


Fig. 3.

cream-colored cashmere or flannel; and when nicely framed, with glass complete, and surrounded with a wreath of ivy or other similar evergreen, looks exceedingly chaste and beautiful. Of course the woods and backgrounds may be varied to suit the taste and conditions, but we advise, in all cases, to avoid very strong contrasts.

The design shown at Fig. 3 is very neat, and one that can be manipulated easily. It makes a side for either an ordinary open wall cabinet, or for a common bracket with three shelves.

We should prefer cutting this design from walnut or mahogany, not less than one quarter of an inch thick. Care must be taken in following the straight lines, as the beginner will find more difficulty in making good work on straight lines than on curved ones.

Our New Departure.

IN response to a very large number of requests, we have decided to greatly enlarge the YOUNG SCIENTIST. This change will take place with the issue for January 1883, and of course the price will at the same time be increased. We have fixed upon one dollar as the future yearly subscription to the YOUNG SCIENTIST, and from the many letters in our possession we feel sure that our new departure will give general satisfaction. The journal will be enlarged to nearly three times its present size, and of course the expense will be greatly increased, but this general advancement means to our readers something more than a mere change in size and price. It means greater variety and scope in the topics selected for discussion in the journal; it means greater thoroughness in working them out; it means more illustrations; it means greater regularity and promptness, and, finally, it means such an organization as will bring the YOUNG SCIENTIST close to every one of its seven thousand readers.

With the price at fifty cents, the manager of the YOUNG SCIENTIST was obliged to be editor, publisher, reporter, etc., etc., all rolled into one. With the higher price and more extended circulation, the YOUNG SCIENTIST will have a special editor with whose special duties no other calls shall be allowed to interfere, and in addition to this the staff of contributors and occasional writers will be largely increased. At the same time the former editor will

lose none of his interest or influence; the YOUNG SCIENTIST will still be what it always has been, the representative of the Amateur Scientist and Mechanic. But with relief from the burden of minute detail comes greater opportunity to accomplish more important things, and maintain more thoroughly the more important departments.

With the January number, Mr. Fred. T. Hodgson, whose name is familiar to every reader of the YOUNG SCIENTIST, will join us in our editorial work. If you desire to see the results, just send on your subscription for 1883, or send by postal card a request for the January number.

Practical Hints.

To Bend a Pipe.—Fill it with melted resin. When the resin hardens bend the pipe, and it will retain its round form. Remove the resin by heating.

Lighting Fires.—Many housekeepers have at some time realized the difficulty of lighting a grate fire in a still, damp morning, when the chimney will not draw, and vigorous blowing proves ineffectual. Science explains the trouble as "caused by the difficulty encountered in overcoming the inertia of the long column of air in the pipe or chimney by the small column of air that can be forced up through the interstices of wood and coal, at the bottom of which the fire is kindled." This may be remedied by first lighting a few bits of shaving or paper placed upon the top; thus, by the heated air's forcing itself into the chimney and establishing there an upward current, the room is kept free from the gas or smoke which is so apt to fill it, and the fire can then be lighted from below with good success.

Blacking Brass.—A correspondent of the *English Mechanic* says: I have tried all the various recipes recommended—nitrate of silver, platinum bichloride, etc.—but never found any work so satisfactorily and cheaply done as by the reduction of nitrate of copper to the oxide. I find the best way of using is to apply the solution to the brass to be blacked with a camel-hair brush, previously slightly heating the metal; then to raise the heat until the requisite color is produced; finishing by rubbing with a soft rag, and either oiling or lacquering. I can confidently recommend this as the very best method of producing that good black seen in first-class optical goods, observing that the process will not do for soft-soldered articles, as the heat necessary to produce the black is greater than the melting point of soft solder.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business matter in letters or cards they are filed away and never reach the printer.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

I have a large assortment of foreign stamps to exchange, also Confederate money. Collectors send sheet and I will return it with mine. Box No. 2, Coeymans, N. Y.

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Any person wishing to trade bird's eggs may apply to me and I will send them my list of bird's eggs. I have only a few at present, but am receiving a number every month. A. G. G., Box 26, Summit, New Jersey.

Minerals of Idaho for Standard Works on the Horse—Wallace's Registers and turf journals. Wanted, also other useful books, bound and in good condition. Many varieties named in my list. J. P. Clough, Junction Lemhi Co., Idaho.

Wanted engraver's tools with book of instructions, for a Victor Press, with cabinet, 2 type cases, type, ink roller and furniture complete; perfectly new. L. Warren, 72 Cumberland St., Brooklyn, N. Y.

A Fletcher Foot-Blower, cost $5, as good as new; will exchange for a Cushman, 2 in. or up scroll chuck, or other make; will give a satisfactory trade on the difference in price, if any. Louis Lutz, St. Clair Street, Toledo, O.

I have a lot of "Galaxy" (magazines) which I would like to exchange for an air rifle in good condition, a collection of birds' eggs, or offers. W. B. Greenleaf, 480 La Salle Ave., Chicago, Ill.

I have a Mechanical Telegraph with book of instructions, books, etc., which I wish to exchange for good microscopical objects, mounted on 3 x 1 slips. Address, with list, J. H. Frey, Millersburg, Ohio.

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Wanted "Quimby's New Bee Keeping," for "Our Own Birds of the United States," by W. S. Baily; new. Joseph Anthony, Jr., Colota, Whiteside Co., Ill.

Wanted a good book in anatomy, in exchange for a book on chemistry, or for story books. A. G. G., Box 26, Summit, New Jersey.

A German-silver trimmed, patent lined, cocoa flute, cost $4, in good order, for good spy-glass, photo-material, or offers. Ewing McLean, Greencastle, Ind.

I have some fossil shells from the west bank of the Mississippi, to exchange for Indian relics. A. W. S., 187 E. 71st St., N. Y.

I have a magic lantern, Ruby pattern, nearly new, and 5 views; also "Our First Century," bound in leather, cost $7; state what is wanted in exchange. I. N. Spencer, Box. 217, So. Manchester, Conn.

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Wanted a book on treatment and care of canary, also breeding of same; will give in exchange book named "Market Garden, Flower Garden and Bees," or "Scientific Americans" or "Seaside Libraries;" we also old books. M. J. Mulvihill, Norwalk, Conn.

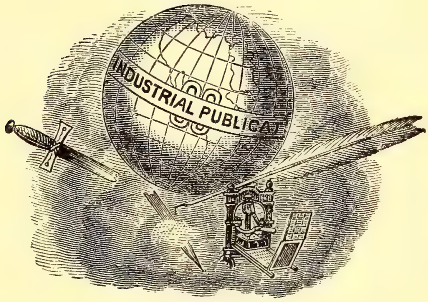
THE

Young Scientist.

A PRACTICAL JOURNAL OF

HOME ARTS.

"KNOWLEDGE IS POWER."



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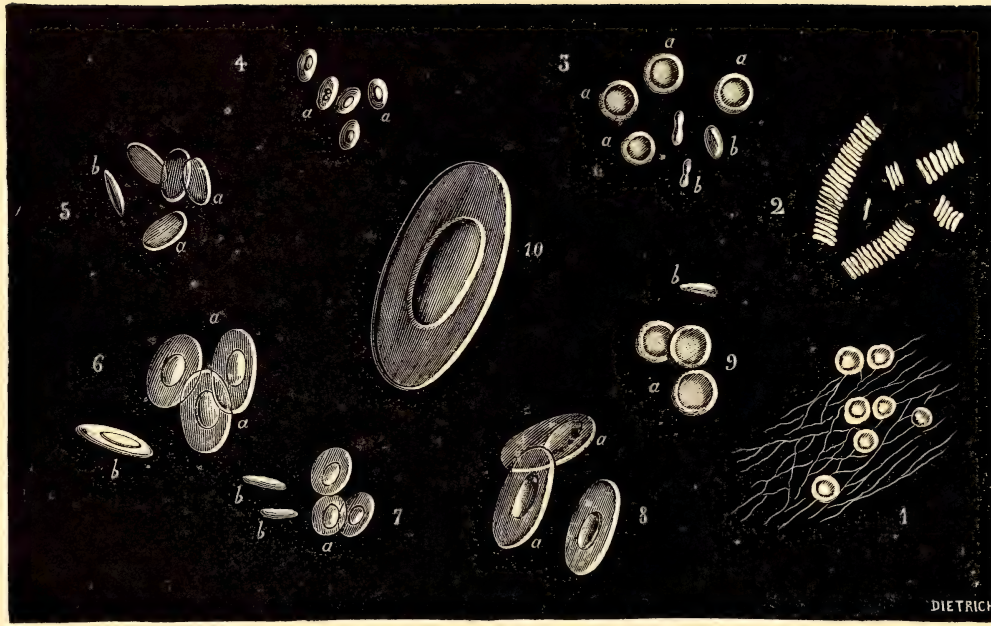

RED CORPUSCLES OF THE BLOOD OF VARIOUS VERTEBRATE ANIMALS.

(1) Red Corpuscles of Human Blood Imprisoned by the Fibrin in Coagulated Blood. (2) Globules of Human Blood gathered in Rolls. (3) Globules of Human Blood in Bi-concave Circular Discs. (4) Globules of Camel's Blood in Elliptical Discs. (5) Globules of Pigeon's Blood, Elliptic Bi-convex Discs. (6) Frog's Blood, Elliptic Discs. (7) Loach's Blood, rounded. (8) Blood of Salamander. (9) Blood of *Lepidosiren*, Bi-concave rounded Discs. (10) Blood of Proteus.

(*a*) Front View of Globules. (*b*) Side View.

The Young Scientist

SCIENCE IS KNOWLEDGE.

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KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

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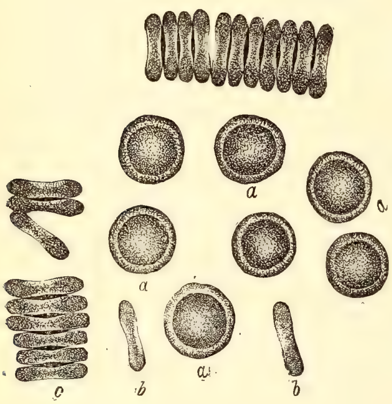
Blood Under the Microscope.

OF all the strange things revealed by the microscope, none are more wonderful than those which have been discovered in connection with blood. To ordinary vision the bloods of different animals appear nearly alike. They appear as a red liquid, differing somewhat in color, etc., under varying conditions, but substantially the same under all. Other red liquids, such as the red juice of fruit, red paint, etc., have often been mistaken for blood, and in some cases it would be almost impossible to prove that they were not blood without the aid of the microscope. There are various animal fluids, which, if properly colored by vegetable colors, might deceive even experts; but when placed under an ordinary ten dollar microscope they at once reveal their true characters, and show an entire absence of those peculiar elements which are always found in blood.

If we take a speck of blood, such as we may obtain by pricking the finger with a pin, or causing some scratch to bleed afresh, and after placing it on a glass slide, spread it out very thinly by drawing another piece of glass or a knife blade across it, we shall obtain the appearance presented in the figure on the next page, when we place the slide under a microscope with a magnifying power of one to three hundred diameters. Here we see some of the corpuscles lying flat, so as to show their round, disc-like sides, as at *a*, *a*, *a*, while others are turned up edgewise and look like *b*, *b*. Sometimes the corpuscles cling together like rolls of coin or *rouleaux*, as they are called, and then they appear as shown at *c*, *c*. There are more corpuscles shown in rouleaux in the engraving than usually occur when a drop of blood is taken from a person in good health, but the form and appearance of the corpuscles are very well shown, and they are the elements which

give to blood its chief peculiarities under the microscope.

These characteristic specks have been called globules, discs, corpuscles and other names, but the term "corpuscle" is the one now generally adopted, as it conveys no statement as to the form of the object. The most curious thing about these corpuscles is that they differ greatly in size and shape in different animals, but are always nearly alike in different individuals of the same species. Thus the blood of all human beings is nearly the same; so is that of all horses, sheep, dogs, fish, frogs, etc., though the corpuscles of horses, fish and frogs differ greatly from



HUMAN BLOOD CORPUSCLES.

each other. In the plate forming our frontispiece we have collected a few of the most marked of these. First of all, the reader will observe that they differ in shape, the round corpuscles of No. 3, presenting a marked contrast to the oval ones shown in 4, 5, 6, 8, 10. As a general rule, the blood of animals which suckle their young (*mammalia*) are round, an example of this being the human blood shown at 3. On the other hand, corpuscles from the blood of birds, fishes and reptiles are generally oval, as may easily be proved by the blood of a chicken or frog—two very easily procured animals. To this rule, however, there are some marked exceptions. Thus the blood corpuscles of the camel, shown at 4, are elliptical, and the blood corpuscles of the loach—a little fish that is found in European waters—is round.

The size too of the corpuscles varies greatly. Thus the blood of the proteus, No. 10, shows gigantic corpuscles nearly 1-400th of an inch long, while the blood corpuscles of the musk deer are so small that it would take twelve thousand of them, laid side by side, to extend across one inch, and we have in our western waters an animal, the *amphiuma*, with corpuscles even larger than those of the proteus. Both the proteus and the amphiuma are allied to the frogs, but are hideous looking objects.

Our readers will now easily understand how it is that microscopists can not only distinguish blood from most other liquids, but can distinguish the bloods of different animals from each other. Thus there would be no difficulty in distinguishing between the blood of the frog (No. 6) and that of a man (No. 3), and cases have arisen where this power on the part of microscopists has carried consternation to those who were not aware of it. Thus it is related that on one occasion a woman presented herself as an out-door patient at one of the London Hospitals, and desired to be treated for spitting of blood. The sputa, or spittle which she brought with her, was colored with blood, but the other symptoms did not tally with this one. The physician quietly made a microscopic examination, and then asked her if feathers had yet begun to grow in any part of her body? She said "No." "That is very strange," said he, "for your blood has turned into chicken's blood, and your hair ought of course to turn into feathers." Seeing that her attempted deception had been detected, she confessed that she had killed a chicken and mixed its blood with her sputa, so as to convince the physician that she was sick, and then obtain, as out-door relief, those delicacies which such people need. Those who will compare Figures 3 and 5 in our plate, will find no difficulty in seeing how the physician detected the fraud.

Another striking case in which the attempted palming off of human blood for

that of a fowl occurred to Dr. Leidey. A man was found murdered by the roadside near Philadelphia, and a market-man was arrested on suspicion. His wagon was found stained with blood, which a microscopical examination proved to be human. His explanation of the blood-stains was that he had carried some grouse to market and their blood had soaked into the wagon-bed. The microscope showed positively and clearly that he lied upon this point, and the jury very properly convicted him of the murder. He afterwards confessed.

In a future issue we will tell our readers how to use their microscopes in the examination of blood, and will describe the best methods of showing that which is probably the most wonderful revelation in the whole field of science—the circulation of the blood in the veins of the living animal.

Sharpening Wood-Working Tools.

BY "OUR NED."

"I DONT see how it is that I can't get my planes to work as nicely as they used to do. They don't seem to be able to cut so sweet or make such silky shavings. I don't understand it. I sharpen and sharpen until I have nearly worn out my oil-stone, yet, although I make them sharp, I can not get good results."

Such were the words of a young amateur friend of mine, who was the happy possessor of a good "kit" of amateur's tools, including a lathe, a good-sized scroll-saw, and a fine lot of carving tools.

His complaint was made to me, with a request that I examine the tools and find out, if I could, where the trouble was, and to suggest such remedies as might, in my judgment, correct the evil.

I examined the plane he particularly referred to, and found that the cutter iron was very dull and stubbed. This condition of things was such that it was impossible to keep the cutter sharp, for the least wear on the cutting edge would be sufficient to render the tool dull and incapable of doing good work. I show, in Fig. 1, the shape of the cutting iron as I found it. Now, by examining this figure, it will be seen that the cutting edge, A, when pushed forward, will work more like a scraper than a cutter, owing to its stubbedness, and that in fact the back of the basil, *i e*, the bevel of the iron at B, pressed against the wood at the back of the cutter, thus preventing it from performing its proper duties. To make this cutter right, and capable of doing its duty, I ground the tool until the basil assumed the shape as shown at Fig. 2. It will be seen that the cutting edge at A is more acute than at Fig. 1, and that the basil, B, in Fig. 2, is longer than at Fig. 1. It will also be noticed that on Fig. 2 there is a second bevel, *e*. I explained the use of this second bevel to my friend as being quite necessary to insure good and effective work. I repeat the explanation here: If a cutter is ground down to its cutting edge, so that the line of the basil forms

Fig. 1.

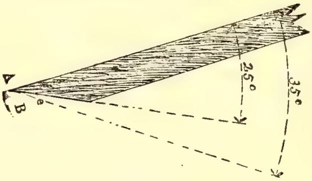


Fig. 2.

an angle of 25° with the face of the tool, as shown at Fig. 3, then by examining the cutting edge, B, it will be seen that it presents a very weak section, much too weak to be lasting or of much service. Indeed,

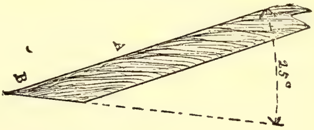


Fig. 3.

a plane-iron or chisel intended for general use, ground to this form, would be apt to crumble or "nip" out on the cutting edge, or if the temper is so fine that no crumbling takes place, the chances are that, in the case of a plane iron, it will "chatter" or spring and shake during

the operation of cutting; this makes the work wavy and full of transverse ridges, thus rendering the work unsatisfactory. Notwithstanding these defects, it has been ascertained that an angle of 25° is the proper one to employ when grinding tools for wood-working. To guard against the defects mentioned, a second basil is made at the cutting-edge at an angle of 35°, as shown at A, Fig. 4. It will be seen

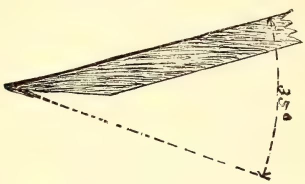


Fig. 4.

that by this method all the defects of the thin cutting edge are avoided, and all its advantages maintained. In grinding, care should be taken to avoid finishing down to the edge, for if such is the case the edge would be ragged and broken up, and would have to be whetted down on the oil-stone a full 32nd of an inch before the cutter would be ready for use.

In grinding tools of this character, the stone should revolve *from* the operator; that is, the top of the stone should move away from, not towards the tool. This gives the operator better control of the work, and gives him an opportunity to see when to cease grinding, which should occur when the basil is brought to within about a 32nd of an inch of the edge. The process of sharpening should be completed on the oil-stone at an angle of 35°, as shown at Fig. 4.

This second basil need be no more than a 16th of an inch from the cutting-edge to its termination on the line of basil; a 32nd of an inch is quite enough for the first few whettings after the tool is ground. Another thing I warned my friend against, and that was making a rocking motion of the hand while whetting the cutter, as this motion has a tendency to give the basil a convex or rounding shape, something like that shown at Fig. 1, which after a while destroys the cutting qualities of the edge. During the sharpening process on the oil-stone, the tool should be held firmly in the hand, with the thumb on one edge and two forefingers on the upper side of the iron, as shown at Fig. 5, with the end resting

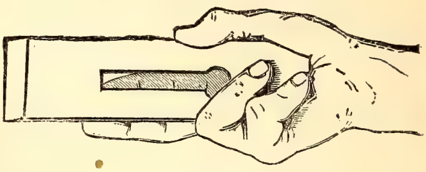


Fig. 5.

against the ball of the hand. The tool should now be placed on the stone and the left hand brought over and pressed on it as shown at Fig. 6. Sometimes the operator will find it more convenient to rest the three forefingers of the left hand on the iron while sharpening; on the whole, however, I prefer running the

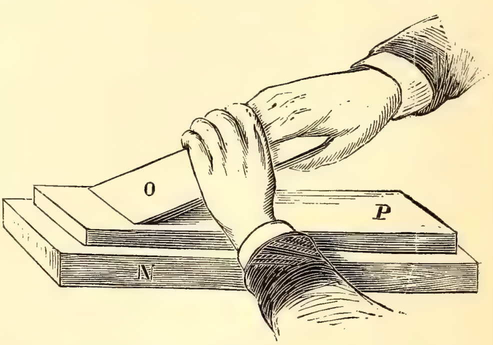


Fig. 6.

hand over, as shown in the illustration, as it enables one to take a very firm hold of the tool. With chisels, gouges, and other handled tools, it is better to lay on the fingers of the left hand than to grip it with the fingers, as it is not absolutely necessary that the cutting edges of these tools should be in a right line, or strictly at right-angles with the edges of the iron. With plane irons this is different; the cutting edge *must* be a right or straight line, and at right angles with the edges of the iron on the smoothing-plane, fore-plane, and long-jointer, but it

is not necessary to be so particular with the jack-plane; indeed, it is sometimes better to leave the edge of the cutter a little rounding, as it works better then for roughing off stuff and preparing it for the finer-working planes.

Another very important matter is the taking off of the corners of the plane irons, so as to prevent the tool from leaving marks on the work, which will be the case if not provided against. It will be seen by examining the iron, O, Fig. 6, that the corners show clear and acute. Now, if the cutter, O, is tipped up a little on the the oil-stone, P, and the corners gently whetted off, the iron will cut sweetly and smoothly without having its efficiency reduced in the least.

It will be seen that the oil-stone, P, in Fig. 6, is surrounded with a wooden case, N. This case serves a two-fold purpose, it protects the stone from breakage, and tends to give it weight and solidity while being worked upon. To make this case, a piece of dry pine should be obtained, about 1¼ inches thick, and about 1 inch wider than the stone, and from 1½ to 1¾ inches longer than the stone. A recess is then made from a half to three-quarters of an inch deep, according to the thickness of the stone. A cover should also be made of wood, to fit loosely over the stone, and which might have its corners bevelled off to give it an appearance of lightness.

All these things being fully explained to my young friend, we set to work to put his tools in order accordingly, and he was astonished and pleased at the result.

On examination of his saws, I found that they sadly needed overhauling and putting in order. This was a more difficult operation, but I undertook the work, and succeeded admirably. In another paper I will explain how this was managed.

— Flannel that has become yellow from being badly washed may be nicely whitened by soaking it two or three hours in a lather made of one-quarter of a pound of curd soap, two tablespoonfuls of powdered borax, and two tablespoonfuls of carbonate of ammonia, dissolved in five or six gallons of water.

Indian Clubs, and the Way to Use Them.

BY JAMES C. SQUIRES.

MANY people who have heard the term "Indian Clubs," are under the impression that these gymnastic implements first originated among our Indian tribes. This is a popular error. "Indian clubs" were used in the East Indies, Persia and China years before the discovery of this continent by Columbus. The date of their introduction into Christendom is unknown, but it is said that we are indebted for them to a military officer who had seen them in use by the Persians. The movements that can be performed with the clubs are almost unlimited in their variety, and are amongst the most useful and beneficial of any gymnastic exercises, having the effect of increasing the muscular power of the shoulders and arms, strengthening the hands and wrists, opening the chest, and also possessing the advantage of rendering the user ambidextrous, or two-handed—that is, of making the left arm, shoulder, etc., as vigorous and able as the right, and developing equally both sides of the body.

If practiced properly, the exercises are exceedingly pretty and graceful, and cause the performer to acquire a good carriage and deportment. Although in almost every gymnasium Indian clubs are now to be found, it is surprising how seldom they are used, the pupils generally preferring to acquire proficiency in the more showy feats that other instruments—such as the horizontal and parallel bars—permit of their practicing. But we would impress upon our readers that if they will only exercise a little patience and perseverance in acquiring the use of the clubs, they will find that no other gymnastic exercises can surpass them in grace and utility, and give such pleasure both to the performer and his audience.

The advantages of the clubs are many; amongst others, (1) they are inexpensive; (2) there is no danger attached to their use; (3) being portable, there is no fixing required—they can be used

either in the open air or in a room; (4) their weight can be adapted to the age and strength of the user.

With regard to the price, they can be obtained of any wood-turner at from 6 to 12 cents per lb. (unpolished). We should certainly recommend the learner to purchase *un*polished clubs, for in the course of practice he is sure to bruise them by knocking them together, and the damage shows more plainly upon a polished than an unpolished surface. But when he has become accustomed to the manipulation of the clubs, then he may obtain the more showy article.

Of course, every boy will know that the clubs are made of wood; elm is the best kind and mostly in use. Sometimes they are turned out of a lighter wood—such as pine—and are weighted to the required extent by molten lead being poured into a hole at the bottom of the club; but we must caution the would-be "clubbist" against buying such an article, for the weight should not be concentrated at the *bottom*, but should be contained in the wood itself, which allows of the club being properly *balanced*, without which true grace and elegance can never be acquired.

As to the shape, that most generally in use, and which is decidedly the best, is shown in the accompanying illustrations.

We now come to a most important consideration—viz., the weight to be used, which should be in proportion to the strength and weight of the performer. It is almost impossible to lay down any law upon the subject, but the following scale may be taken as a guide:

For a boy of	10	years old,	$2\frac{1}{2}$ to 3 lb.	each club.
"	11	"	$3\frac{1}{2}$ to 4 lb.	"
"	12	"	$4\frac{1}{2}$ to 5 lb.	"
"	13	"	$5\frac{1}{2}$ to 6 lb.	"
"	14	"	$6\frac{1}{2}$ to 7 lb.	"
"	14	and over	$7\frac{1}{2}$ to 8 lb.	"

These figures refer only to the light clubs or dual exercises—that is, when a club is used in each hand. For the single, or "heavy club" exercises, of course, the weight can be increased, but of that we will treat later on.

Many of our readers may consider these weights "a mere nothing," and quite unworthy of their muscular powers. But it is a great mistake to suppose that the benefit to be obtained from Indian clubs is in proportion to their weight, and in the exertion required in manipulating them. On the contrary, the easier the exercise (within reasonable limits of course) the better, for practice being then a pleasure, can be sustained for a longer period, and by this means the muscles become gradually developed, and subsequent fatigue is avoided.

We have said that the weight of the club should be in proportion to the *weight* of the user. We will justify this advice by an explanation. We will suppose that a boy of twelve years of age weighs 84 pounds, and another boy of the same age weighs 91 pounds; the latter, (presuming both boys' muscular development to be about equal) could use a heavier pair of clubs than the former, because he would have greater weight in his body to counterbalance the weight of the clubs.

In order to impress our young friends with the correctness of this principle we would point out to them that in performing exercises upon a fixed gymnastic apparatus (such as the horizontal bar) the gymnast has only to use muscular exertion proportionate to his bodily weight. If, however, he were to carry about him any weighty articles, or even wear a pair of heavy boots, he would experience a greater difficulty in performing the exercise, and perhaps fail altogether, and his exertions would soon produce fatigue. Therefore do not be too ambitious in selecting your clubs, but be contented with the weights we have recommended, which, although they appear small *on paper*, will be found quite heavy enough *in practice*. The writer, who has used the Indian clubs constantly for the last ten years, never has a pair of greater weight than eight pounds each.

The length of the clubs must be varied to the height of the performer. With the clubs standing on the ground and the hands hanging down, as in Fig. 1, there should be a space of about two inches between the handles and the tips of the fingers, so that it becomes necessary to stoop slightly in order to grasp the clubs. When swung round they should

clear the tops of the toes by about two inches.

With regard to dress, the ordinary gymnastic suit, shown in the illustration, is the most suitable. The best material to make it of is undoubtedly white flannel. A pair of flannel pants made to fit the

Fig. 1. Fig. 2.

legs tolerably closely, with plenty of room in the seat (not baggy of course), a close-fitting ordinary undershirt minus the sleeves (to give freedom to the arms), and a pair of canvas shoes without heels, are all that are necessary for wear during actual practice. Add to these a loose jacket of medium thickness to slip on during intervals of rest, and you have your costume complete.

But for Indian club exercise a special costume is not indispensable—and here, again, their economy is manifested—and all that need be done is to divest oneself of coat, vest, and over-shirt, and practice in ordinary pantaloons, boots, and undershirt.

Before proceeding to describe the different exercises, we would impress upon the reader most emphatically that in endeavoring to perfect himself in them he should bear in mind that, performed *gracefully*, and with an easy, swinging motion, there is nothing prettier. On the other hand, a jerky and strained action spoils entirely not only the effect from a spectator's point of view, but also neutralizes the benefit that should accrue to the performer.

First Position (Fig. 1). Place the clubs upon the ground, one upon the right and one upon the left side, slightly in front—about level with the toes. Stand at attention, head erect, shoulders square. Then bend down, grasp the clubs, one in each hand, and raise them up until the hands are level with shoulders, at the same time separating the legs and placing the feet apart, toes pointing outwards (as in Fig. 2).

Fig. 3.

You will then be in position to commence *Exercise* 1 (Fig. 3). Throw out the clubs to the right, and describe a complete circle with them in front of the body from the right to the left, *keeping the arms perfectly straight and in a line with the clubs.* As they describe the circle the body should be turned slightly in the same direction, and the head and eyes also should follow the course of the clubs from right to left. Continue this exercise at least a dozen times. Should you find any difficulty in accomplishing this with both clubs at once, try one at a time, first with the right hand and then with the left, or *vice versa.*

Here we will take the opportunity of informing the learner that he should en-

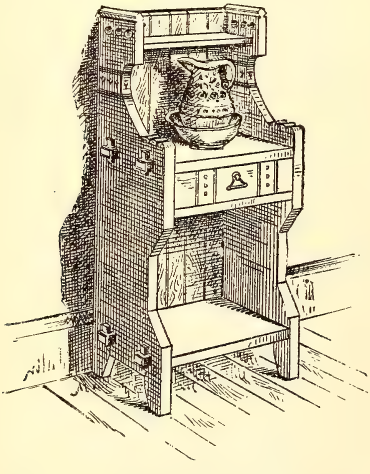
deavor to *identify* himself, so to speak, with the clubs, and consider that they are parts of himself—continuations, in fact, of his own arms. The base of the club should always be kept in a straight line with the shoulder. By this means an equal distance is preserved between the two clubs; otherwise, should they be swung at an angle, they must surely come into collision in the next exercise (and in many others to follow), and in which one club travels in an opposite direction to the other.

(To be Continued.)

A Simple Washstand.

FOR simplicity of construction, neatness of design and compactness, in the way of a washstand, such as can be made by an amateur, we have seen nothing that will compare with the one shown in the accompanying illustration.

The sides are formed of clear plank, and are mortised for the shelves. The scroll-saw may come into play in cutting out the sides. Three holes are bored in each of the sides near the top, as may be



WASHSTAND.

seen. These holes are about one inch in diameter. A little spray is incised around the narrowed parts of the sides, but this operation may be dispensed with if the amateur does not feel equal to its performance.

Each of the main shelves has two tenons left on each end to fit into the mortises made through the sides. The tenons have little wedges inserted in their ends to draw the sides of the stand snug up to the shoulders. The narrow shelf on the top, and the shelf supporting the drawers, are made of thinner stuft than the two main shelves, and may either be housed—*i.e.*, let in to the sides—or they may rest on little cleats screwed neatly under them.

The back is formed of thin stuff, tongued and grooved together, and is screwed to the shelves and sides. A little cap or coping is nailed or screwed on the top of the back, and buts against the two sides.

The drawer is made in the ordinary way, and has one of Shannon's brass or nickle-plated drawer pulls attached. The lower part of the sides may be left straight down from the drawer, and a valance or other drapery may be hung from the shelf under the drawer, by means of a metal or wooden rod, with sliding rings to which the drapery is fastened; or a simple fringe might be hung under the drawer.

The wood used in making this stand should be of a lightish color. Ash, oak, chestnut, or any of the pines, will look very well if properly handled. Of course the wood must be left its natural color, and filled with a "wood-filler" of some kind, and then varnished or polished. Wood-fillers can be obtained from any dealer in paint, oils, etc., and the directions for their use are generally pasted on the can containing the filler.

As soon as the stand is made, steps should be taken at once to have it varnished or polished, for the woods named are extremely porous, and if dust or dirt once gets into the pores, it will show through, no matter how much filling or varnish may be applied, and the only way to neutralize the effect is by staining the whole work dark.

This makes a very neat piece of furniture, and is in the prevailing fashionable style, being Queen Anne in character.

Walking-Sticks: How to Make Them.

BY GEORGE EDWINSON.

AT most periods of our lives we display a fondness for sticks. Even in the palmy days when vigorous manhood does not require a staff to support his tottering footsteps, he invents some other excuse as a reason for carrying a stick in his hand, and feels still more lonely in his lonely walk if he happens to have left the mute companion of his travels at home. A variety of tastes are displayed in the selection of walking-sticks—tastes not always governed by the necessities of the selector, nor by the fashion of the day, but sometimes by some peculiar idiosyncrasy of the individual. Hence, whilst some prefer a lithe holly stick, or hazel, others prefer ash or elm, others are content with nothing less than a stout oaken cudgel, and a son of Erin would revel in a tough little bit of blackthorn in preference to all other woods. Some again scorn our homely woods and will carry nothing commoner than a foreign cane or bamboo fitted with a head of gold or silver; others prefer those with grotesquely-carved heads, and not a few take a pride in carrying a stick cut or pulled by their own hands from hedge, copse, or wood. But a stick thus pulled or cut is apt to betray the ignorance of its owner by its rough head, its cracked and scored shaft, its crookedness, its rough bark, or its unpolished condition. To meet the wants of those who would like to prepare such sticks for themselves, the following hints are given, and may not be unacceptable.

Walking-sticks should not be cut or pulled in the spring later than the month of February nor earlier in the autumn than the month of October; the best time of the year being from the first week in December to the last week in February. Sticks should be laid aside in only a moderately dry cool place, and should not be worked nor the bark taken off until they are half dry, then they are most supple and may be bent or straightened without injury. In laying by sticks to dry, the knots should not be trimmed close—in fact, it is best to only rough-trim the stick, leaving the spurs of branches and of roots on the stick fully an inch long. The following kinds of woods are pulled and cut for walking-sticks in addition to others not enumerated here.

Holly.—Sticks of this wood are found growing out from the side of older stems, and shooting up in nearly a straight line through the dense foliage above. Occasionally they may be cut with a crutch piece across the growing end, or with a crook or knob. These are the most valuable. Luck may sometimes happen on a well-grown sapling in the deep wood, this should be pulled or dug up for the sake of its roots. Saplings and hedge sticks may often be found, from 3 to 4 feet long, with the top part to the length of a foot, from $\frac{3}{8}$ to $\frac{1}{4}$ inch in diameter; these are not suitable for walking-sticks, but they make excellent whip handles, and are used for this purpose by country teamsters. Holly sticks should only be rough-trimmed when green and put away in this state to season. They make tough, supple, and moderately heavy walking-sticks, and their closely grained wood admits of the carver's skill being exercised on the knob, formed by the root and its rootlets.

Ash.—Respectable sticks of this wood may sometimes be cut out of a hedge, or pulled from the side of an old stump or pollard, but the quality of such sticks will not compare with that of sapling ash, pulled or dug up in some copse or wood. Sapling, or "ground" ash, as it is called, vies with holly for toughness and suppleness, whilst sticks of equal size yield the palm to ash in point of stability, but to holly for durability. Hedge sticks of ash get brittle as they get dry and old, and the same remark applies to most sticks pulled from old stumps. Ash sticks must also be rough-trimmed and well seasoned before they are barked and polished. The wood and curiously formed root-knobs of ground ash will admit of excellent grotesque carving.

Oak.—This of all sticks is the most reliable, and stout oaken cudgels are esteemed by most persons as some of the best props to failing legs, as well as the

best weapons for self-defence against quarrelsome dogs and rowdy ruffians. Straight sticks of sapling oak are not always easily obtained, but copse-wood sticks pulled from the stumps of trees form excellent substitutes. These should be selected for walking-sticks which taper gradually from $\frac{3}{4}$ of an inch just below the knob or crutch, down to $\frac{1}{2}$ inch at the opposite end. Gnarled and crooked oak sticks are sometimes fancied, and heavy cudgels are sometimes selected for defensive purposes. Oak sticks split in drying when the bark has been stripped off, or the knots cut too close, or the sticks put away to dry in a very warm dry place; they are then rendered useless for walking-sticks and cudgels. The wood and also the form of the knobs or roots will admit of much taste being displayed in grotesque carving.

Elm.—From the roots of elm trees, saplings with a coating of rough bark will shoot up straight to a height of some ten or twelve feet. These will furnish some good walking-sticks of the fancy type, the rough bark serving the purpose of ornamentation when the sticks are dried, stained, varnished, and polished. The wood is also durable, but not very supple when dried, and sticks of it are not suitable to hard usage. The usual precautions must be taken in drying them.

Hazel.—Light sticks of this wood may be cut or pulled from almost every hedgerow and in any wood. Saplings are not unfrequently found of most symmetrical proportions, tapering from 1 inch down to $\frac{1}{4}$ inch through a length of some ten or twelve feet; these form very tough sticks of any desired size. The wood is very light, but it has the disadvantage of bending and remaining crooked when leaned upon heavily. It is also soft, and may be easily carved. Occasionally, hazel sticks may be found grotesquely entwined with honey suckle, and its stem so deeply furrowed with the supple vine as to enclose the convolutions of the climber. Sticks of this kind are valued as fancy sticks, and look well when properly prepared, varnished and polished.

Blackthorn.—This is the wood of the bush which bears the sloe, and the bullace or wild plum. In exposed positions it is only a dwarf shrub, but in sheltered hedgerows and woodlands it attains a height of some twenty feet, and its saplings run up to a length of from six to eight feet straight and taper, but covered with stout spines and small twigs. Those saplings make excellent walking-sticks, both when they can be dug or pulled up, and also when they have to be cut off. The spines and twigs must not be cut off close until the stick is half dried, and then cut with a sharp knife; in fact, the knots left from the spines and twigs when left as slight round excrescences enhance the beauty of the finished stick. Blackthorn is more famous for its hardness, strength, stability, and durability than for lightness, elasticity, and suppleness. A cudgel made of blackthorn will deal heavy blows, but when matched against one of oak would splinter at the knots, the oak being the tougher stick. The wood is hard and not easily carved, but the root knobs will admit of a very fine and smooth polish, most grateful to the palm of the hand of the tired pedestrian. Its congener, the whitethorn, or hawthorn, is not so suitable for walking-sticks, being more brittle and less durable, but it is sometimes used for this purpose.

Among fruit trees, the cherry will furnish some very nice fancy sticks, supple, and of tolerable strength; and apple wood, when well and carefully dried, will yield some good sticks. Grapevine and briar sticks are sometimes used, but they cannot be relied upon for stability when leaned upon.

When sticks are half-dried, that is, when the bark is shrunken, has lost its sappy greenness and refuses to peel freely, they may be trimmed, straightened, or bent as required. To straighten or to bend them, they may be held over steam until rendered supple, or buried in hot wet sand until this end has been attained, they must then be given the form they are intended to assume (whilst still hot), and kept in this form until they are cold, straight sticks being tied firmly in small bundles, and wound with a coil of rope from end to end, or suspended from a beam

by the knob end, whilst a heavy weight is hung from the small end. Crooks may be turned by immersing the end in boiling water for five or ten minutes, then bending it to the desired form, and securing it in this position with a tourniquet (Fig. 1) until the stick is cold. The bark may next be taken off with a sharp knife, if so required, and care must be taken not to splinter or chip the wood of the stick. then any amount of skill in carvings may be expended on the knob; but if the stick is for use, we should first consider its use. Round smooth-headed knobs (Fig. 3) carved and polished to fit comfortably into the palm of the hand, will meet with most acceptance from those who use a stick as a support. But knobs thus formed, and shorn of a projecting crook or hook, often slip from beneath the arm or out of

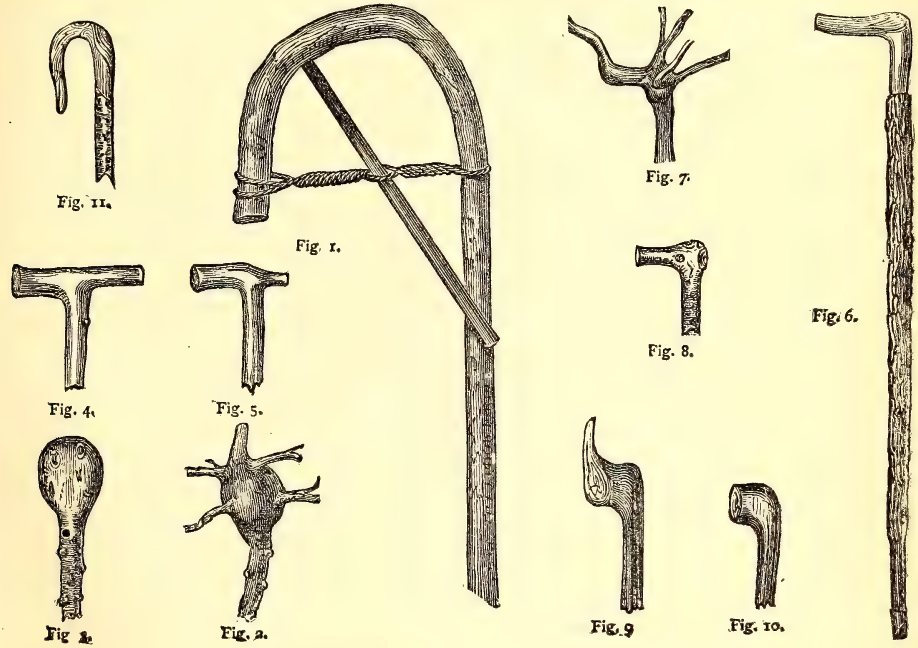


Fig. 1.—Crook Stick, showing method of turning crook by means of tourniquet. Fig. 2.—Blackthorn Knob, rough. Fig. 3.—Blackthorn Knob, trimmed. Fig. 4.—Crutch Form of Crook. Fig. 5.—Half Crutch. Fig. 6.—Elm Stick. Fig. 7.—Ash Root, as dug up. Fig. 8.—Ash Root, trimmed. Fig. 9.—Ash or Oak Knob, as pulled from pollard or stump. Fig. 10.—The Same, trimmed. Fig. 11.—Stick Bent and Trimmed to form Crook.

Knots may be trimmed at the same time, and the knob trimmed up to shape. Hard and fast rules cannot be given for the formation of knobs, since their form must be regulated by the natural knobs, and these are often very suggestive in themselves. One or two things should, however, receive consideration in designing a knob, and the first should be the ultimate use of the stick. If the stick is to be a fancy one, to be carried and swung in the hand, more for appearance than for use: the hand when its owner wishes to use both hands for some purpose—for instance, to light a cigar or a pipe. The head of a dog with a long muzzle, the head of a swan or a goose, forms an appropriate design for such a stick. The crutch (Fig. 4) or half-crutch form (Fig. 5) is also a comfortable one, but the ordinary crook (Fig. 1) although useful for many other purposes, does not fit comfortably in the hand, it is too much of a handful, and the central support usually

finds its bearing under the forefinger instead of the palm of the hand. Sharp carving on the knob should always be discouraged, for it only hurts the hand, but the neck of the knob may receive the carver's attention. We shall avoid reference to fancy sticks with metal heads of gold, or silver, or silver plated brass, and to those clever contrivances, which store a *multum in parvo* of tools in the head of the stick; also leaving out of our consideration, the loaded stick with its half-leaden head, and that barbarous relic of the dark ages, known as the sword-stick—these we will leave in professional hands.

Elm sticks with the rough bark left on (Fig. 6) must be neatly trimmed naked around the neck of the knob, and at the bottom of the stick just above the ferrule, loose bark should also be neatly trimmed with a sharp knife, and the whole lightly gone over with medium glass-paper. The stick should then receive a dressing of boiled linseed oil, and be left to dry. When dry, it will be well to go over the smooth parts with a little polish, and finally give one or two coats of hard spirit, or of copal varnish. Holly, ash, hazel, cherry, apple, birch, etc., should have part of their bark only taken off with a sharp knife, leaving all knots smoothly trimmed, rounded, and clean. The sticks should be then lightly glass-papered, and when smooth, dressed with boiled linseed oil, dried, polished, and varnished. Oak sticks look best when carefully barked in hot water, cleared of the loose bark by rubbing with canvas, dried, dressed with boiled linseed oil, again dried, then polished and varnished with oak varnish. Blackthorn sticks should be only partly barked, the knots smoothly trimmed, then glass-papered quite smooth, dressed and varnished as directed for other sticks. Sticks may be stained black after they have been glass-papered, and before they are dressed with oil, by first brushing them over with a hot and strong decoction of logwood and nut-galls, and when this has well-dried, brushing over them some vinegar or acetic acid in which a quantity of proto-sulphate of iron, some iron rust, or some old rusty nails have been steeped some two or three days previously. A brown or mahogany tint may be given by adding some dragon's blood to the polish, and a yellow tint may be obtained by adding yellow ochre. Some persons use ink for a black stain, and others put drop black in the varnish, but the black stain above mentioned is preferable to all others. The sticks are to be polished and varnished after the stain is dry. The bottom ends of walking-sticks should be guarded from excessive wear by a neat brass ferrule, but these are more cheaply bought than made. They should be secured to the stick by two small screws, one on each side of the stick, to prevent them from coming off when they get loose in dry weather.

Amateur Brass Work.

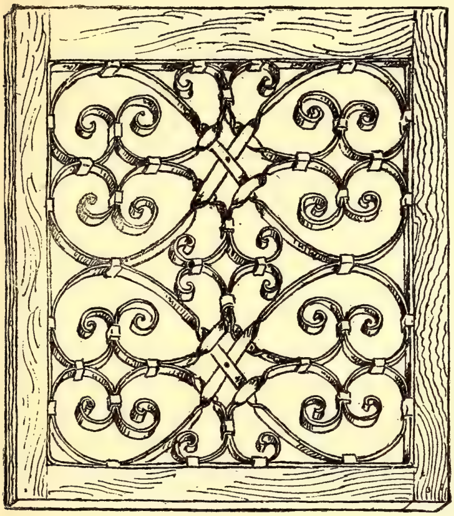
NO doubt many of our expert amateur readers would like to work in other materials than wood or iron, but are deterred from doing so by not knowing how to take advantage of the facilities offered by brass, bronze, stone, and other like materials. It is easy to see how wood may be converted into various uses and forms, but to the uninitiated the difficulties of employing brass for artistic purposes and yet be within the range of the amateur, are frequently magnified into insurmountable obstacles. Brass, however, and many other materials, may be worked with nearly as great facility as the softer substances, and in future numbers of the YOUNG SCIENTIST we intend showing how many artistic and useful things may be made by the amateur from the sterner materials.

The illustration shown herewith will give an idea how a metal grille or guard for a panel in a cabinet—to take the place of wood or glass—can be made quite readily out of narrow strips of any sheet metal, by simply bending with the fingers and a small pair of pliers.

Soft brass would be best for the amateur to try his hand on first, as it is tractable and easily worked.

The design should first be laid out full size on a board, when it will be found an easy matter to bend the strips of metal

into their proper shape. The fastenings at the intersections are pieces of the metal bent around and pinched tight by the pliers. A strip of the metal should be bent around and fastened to the entire

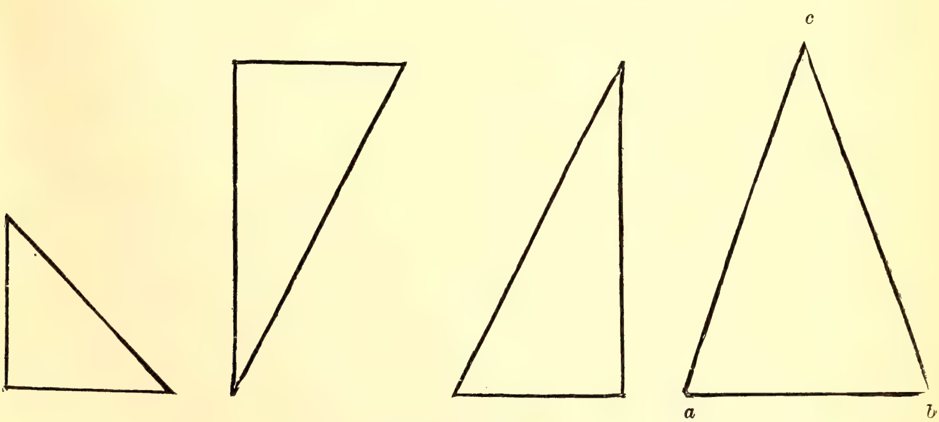


pattern for the purpose of attaching it to the stiles and rails of the panel or frame. At the intersection of the centres of each main section of the design, where the metal is twisted to show its flat surface to the face, rivets are used to hold the parts together.

This kind of work may be applied to a thousand different purposes. It looks particularly well when used in making a summer fire-place screen, and wrought of brass, lacquered, has a very rich appearance. Narrow hoop iron, strips of galvanized iron, zinc, heavy tin, or other materials might be used, each kind being suitable for some particular purpose. When hoop iron is used it should be either bronzed or japaned.

A Mathematical Puzzle and a Lesson in Geometry.

OUR very young readers who wish to exercise their mathematical abilities may cut out four pieces of cardboard, the exact size and shape of the figures given below, and try to put them together so as to form a perfect square. There are several methods of transferring the figures to cardboard so as to get the pieces the exact size and shape required. One is to lay the cardboard under the page, and stick a pin through the three corners or angles. The pin marks must now be joined by lines drawn with a ruler, and the figures will be complete. Another way is to draw the figures on transparent paper laid over the page, and then gum the thin paper firmly to the card, after which card and paper may be cut up as required. But the most elegant method is to draw the figures geometrically. Take the left hand figure to begin with and draw a straight horizontal line. Then with a pair of com-



MECHANICAL PUZZLE.

passes take the length of the line $a\ b$ and mark it off on the line just laid down. Now take the line $a\ c$ in the compasses, and with a as a centre, strike an arc at c. Do the same with the line $b\ c$ and the point at which these arcs cross is the point c. Then draw lines between $a\ c$ and $b\ c$ and the figure is complete.

In our next issue we will give an engraving showing the method of placing these figures so as to form an exact square.

Christmas Decorations.

BY A. W. ROBERTS.

SO many are interested in the subject of Christmas decorations, both for the home and the church, that I am sure a few hints on the subject will be welcome. In the way of material, there is an abundance to be found in all our woods. There is the hemlock, arborvitæ, spruce, laurel, ink-berry, holly, rhododendron, and the junipers and cedars among the trees and shrubs. Then comes the three varieties of club mosses, or lycopodiums, of which the variety known as "Bouquet Green," or ground pine, is most useful for small work. Then come our berries, catkins, and cones, and also the evergreen ferns. Next to these it is entirely proper to use pressed Autumn leaves and ferns. Also, from the garden may be obtained the golden and other varieties of the arborvitæs, box, English ivy, and other evergreens, which, by judicious selection and trimming, will afford useful material.

The immense trade in Christmas greens, which begins two weeks before the holidays, is one of the most striking features of Washington Market. These evergreens are procured from almost every part of the United States east of the Alleghanies. From the vast wilderness of Maine steamboat loads of Christmas trees are delivered at the Boston and New York markets. The cedar, lycopodium, and holly come from New Jersey and Pennsylvania; Virginia leads all other states on holly, laurel and bay, and England and Florida on mistletoe. It has become the custom, of late years, with English people, to send a living branch of mistletoe, as a Christmas present, to their friends and relations living in "the States."

When one sees the immense loads of

Fig. 1.

Christmas trees that are received at the market, he wonders what becomes of them, and who purchases them; and as they range in height from four feet to twenty-eight, and even thirty, and in price from twenty-five cents to $15, he becomes still more puzzled. And yet, even all these very small and very tall trees do not fill the bill, for even to-day, as I was obtaining my notes, a gentleman wished to obtain a tree forty feet high, and was willing to pay a dollar a foot for it. This tree was for one of the Brooklyn orphan asylums, and was to be hung and ornamented with all kinds of toys, presents, bon-bons, etc. Next to the trees

and loose evergreens, come roping, wreaths, stars and other emblems.

It is estimated that to decorate an averaged-sized sitting room or parlor

Fig. 2.

with first-class roping, wreaths, stars, and crosses, will cost from $3.50 to $4, and to my mind there is nothing prettier than a tastily decorated room at Christmas time.

This Christmas the æsthetic sunflower and peacock feathers will be extensively used, in combination with holiday decorations, also chromo pallettes and plaques, now so much in vogue. When decorating a room, particular attention should be paid to portraits of relations and friends that are deceased; these should receive marked tributes of greenery.

In purchasing evergreen emblems be sure to avoid everything that contains those abominable tissue-paper roses; also look out for wreaths, etc., containing the panicles of the terribly poisonous sumac berries, of which I saw many hundreds in Washington Market last year.* There are also many wreaths for sale in the market, composed of a light-grey lichen, which, as soon as it becomes dry, also becomes very brittle, and falls away. To increase the effectiveness of these wreaths, they are often dyed with cheap aniline dyes. One of the most effective, and at the same time ingenious ways of ornamentation, in conjunction with Christmas greens, that I know of, is the use of tissue-paper banners. These can be got up at a slight cost, and in designing them, all that is artistic and graceful in form, design, combination of colors and materials, can be displayed by the designer. These banners may be patriotic or religlous, or they may contain mottos and emblems significant of Christmas, or home mottoes, such as "Welcome to All," "Welcome Home," "Love One Another," etc., etc. The materials used being the best quality of tissue paper of the most brilliant colors, gold leaf and silver leaf—dutch metal will answer every purpose, and comes much cheaper than the real metals. Silver and gold papers are used for lettering and fringes, also blue and crimson paper for lettering. For staffs use painted dahlia sticks, which may be procured at any seed store; top them off with a pine cone touched up with gold leaf.

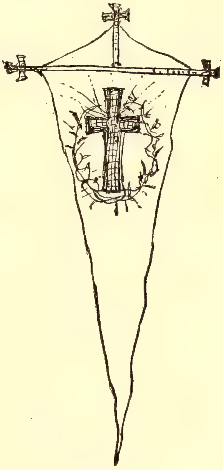


Fig. 3.

When using small wax tapers for illuminating the Christmas tree, the greatest of care must be taken when lighting them not to set the tree on fire, as it must be borne in mind that after a few days in a hot room these trees become very combustible, and flash up so quickly that not the least warning is given before the lace

* Since writing this article a case of very severe poisoning from the poison sumac, is reported from New Jersey. A lady, when decorating a church for the annual Autumn services, handled some of these poisonous plants, and was so severely injured that her life was endangered. In a future number we will give such descriptions and cuts of these poisonous plants as will enable our readers to readily recognize and avoid them.

curtains of the windows at which the tree stands are also on fire. The better way is not to place the tree at or near any window, but have it in the centre of the room. Flowers and plants in pots can always be used with great effect for Christmas decorations. To avoid the ugliness of the bare pots, cover them

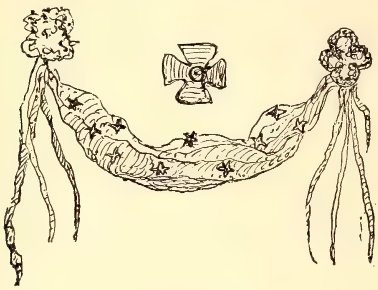


Fig. 4.

with sheet moss from the woods; this material may be fastened on with fine wire or thread. If the moss is not obtainable, bank up the pots with evergreens. I have sometimes seen very small hanging fish-globes, containing one small gold fish, so arranged as to produce

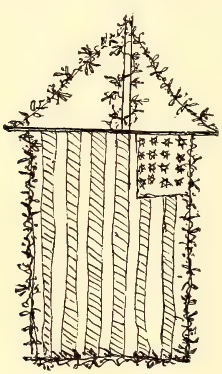


Fig. 5.

very beautiful effects. The best receptacles in which to plant or fasten the Christmas tree is a half butter tub nailed to a square piece of two-inch stuff. The tub, and the square of timber to which it is fastened, are painted green, and while the paint is moist, pulverized wood moss is dusted on it; don't attempt to represent a miniature picket fence, with wooden sheep and shepherdesses, but let it be an honest substantial butter tub filled with earth. I have made a number of offhand pen sketches as suggestions of shapes of banners and appropriate mottos. Fig. 1 shows how two styles of banners can be cut from one slip of paper with the least loss of material. Figs. 2 and 3 are cut out on the same principle, while Fig. 4 is a patriotic design, consisting of a festoon of red, white and blue tissue paper, bespangled with silver or gold-paper stars. The ends of the festoon are caught up with a rosette, from which streamers depend. Fig. 5 consists of a cheap muslin American flag, bordered with lycopodium trimming.

Our Girl's Department.

THIS department is intended exclusively for "Our Girls," and we hope to make it both interesting and instructive, and to this end we ask our young lady readers to assist by contributions, suggestions, or illustrations. There are thousands of little things that can be, and have been, made and done by young ladies, pertaining to decorative art, needlework, etc., etc., that would be gladly followed but for a want of knowledge on the subject, and we know of no more pleasing task for a lady than that of teaching her younger sisters that which they are anxious to learn, and which may prove of real benefit to them in the future, as well as being useful and interesting for the present. We trust we will have no difficulty in persuading those who have something nice to show or speak of, to make use of this department. Remember, it is open to all, and if you have anything worth knowing suitable for this column, send it along, and we will give it our best attention. Do not be afraid to write because you may fancy your composition is not perfect, or have other scruples of a similar kind. Do the best you can, and leave the rest to the editor of this department, and we are sure you will be pleased with your work.

THE WORK BASKET.

The style of netting shown in Fig 1, is sometimes called "letter B netting," because the pear-drops in the meshes form

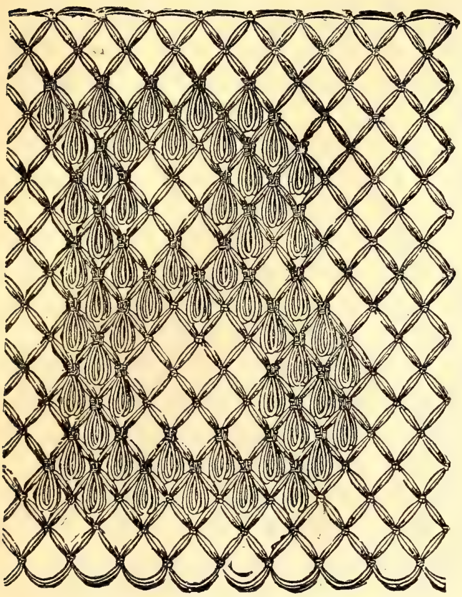


Fig. 1.

the letter. For working it a double strand is required for this netting, with a mesh of proportionate size. Any netter will find it easy to reproduce the pear-drops which dot the initial itself; they are formed by winding the thread or silk twice round the mesh after the stitch is completed, and securing those pendant loops by a knot. To allow them to fall nicely they are each separated by a plain stitch. All letters can, of course, be represented in the same pretty style, besides many simple patterns, as the diamond, star, etc. Indeed, cross-stitch designs would be a guide for borders and powderings executed in this method.

Such initials are used for sachets, night-dress bags, pillow cases, cushions, etc., but to show up well should always be lined with some bright-colored sarsanet or sateen.

Katie B—— sends the following: "For outline embroidery the simple ordinary backstitch is used. When the lines are required to be very fine they are worked in very fine; bring the needle out through the centre of the thread, instead of coming to one side of it. The stiches should be of the same average length and the outline should be followed exactly. Measure the distance with the eye and avoid a sudden shortening or lengthening of the stitch. Care must be taken in working to have the stitches lie flat. Always work with a short thread, as otherwise the silk or cotton will become rough. Never work with too small a needle, as it will drag the material.

Sadie R—— says: "To made a very pretty card basket, construct a framework out of stovepipe wire to the shape desired, then take about three pounds of alum and three quarts of water, boil until the alum is dissolved. Suspend the wire basket in this solution, and let it remain for twenty-four or thirty-six hours, at the end of which time it will be found covered with beautiful alum crystals."

The manner of making the wire framework is very simple and will suggest itself. The basket, when made, looks very handsome. Many other things besides baskets may be made and covered with alum crystals by the same process, and it does not necessarily follow that wire be used in the construction of the framework. Cotton wrapping cord will, in many cases, answer just as well as wire, when it can be fastened to some substantial frame-work.

Fig. 2 shows a knitted check pattern, which is not difficult to follow. The blocks may be colored to represent some of the various tartans and devices of Scotland; but here, to prevent the extra thickness gained by carrying the wool across at the back, each check is made separately on the bias, and deftly knitted together. Hence, while the Scotch mode rather tightens the material, this new slantwise way gives it a great deal of elasticity, so much so, that when used for stockings, one-third of the ordinary stitches may be suppressed.

In the cut, the blocks are eight stitches square, and of two colors; but when selected as borders for petticoats, quilts, etc., much larger squares can be obtained

by calculating from twelve to sixteen, or twenty stitches, and taking coarser wool. Also more diversity may be introduced into the coloring by the blending of several contrasting hues, or the artistic shading of one color, from the lightest to the darkest shade, and *vice versa*. Even when executed in a single tint the blocks can display change, by intermingling with the plainly-knitted checks others of purl, ribbing, moss-stitch, etc. To work the pattern, take any number divisible by eight, according to the size required. For the four checks of the illustration cast on thirty-two stitches, and set them, if for large work, by one plain and one purled row. 1. Half squares.—Knit plain, with the darkest color, eight stitches; leave the remaining twenty-four aside, turn the work, and with a third needle purl back, taking the last two stitches together. Repeat this at every alternate row, till there is but one stitch left on the needle. Thus in the third row you will knit seven, in the fifth row six, in the seventh row five, in the ninth row four, in the eleventh row three, in the thirteenth row two, in the fifteenth row one. Your reductions have been made on one side only. Now, with the needle which bears the one stitch, pick up and knit seven stitches along the opposite side, which will bring you back to the twenty-four stitches. In raising the loops, take up the *back* part of every other stitch. Leave this needle untouched. The first triangle is complete; proceed to the following one by knitting

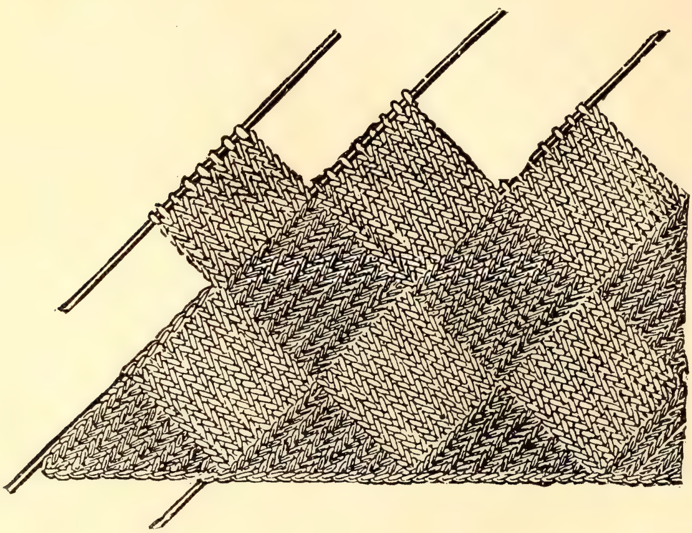


Fig. 2.

off eight more loops, and decreasing them as before; pick up the stitches of the straight side again, leave them on the needle, and continue in the same way to make two more triangles with the sixteen remaining stitches.

Second row. Complete squares.—The first row has produced four triangles, on each of which has been left a needle holding eight loops. These sets of loops form the foundation of squares which, sloping in a reverse direction, fill up the spaces between the triangles. They are likewise made separately, and joined to the side of the half-squares whilst working. Proceed thus:—With contrasting wool, purl the eight loops of either the first or the third triangle; it does not signify at which end you commence. Knit back seven of the stitches; then slip the last loop off on to the needle already full. With the needle now at liberty, lift up the back part of the first stitch on the de-

creased side of the next triangle; pass the eighth, or unknitted loop, on to its own needle again, and knit the two together; but *from the back*, for the last loop of the square being made, always falls *over* the picked-up stitch. Return by purling, and continue in each knitted line to raise a stitch from the side. As eight are to be picked up, every alternate loop will, of course, be taken. Remember, also, to seize the front part of the side loops, to avoid showing any ridge. When the first square is completed, leave the eight loops, as before, on the needle, and proceed to work on the loops of the following triangles in the same manner.

Third row.—Here we have another series of squares or diamonds fitting into those below; they are executed on a like principle, but in a contrary direction, their slope corresponding to that of the triangles. Raise eight loops with the dark wool again; this time on the right instead of the left side of a block; purl them, turn, and knit together in the ordinary way, the last loop of the light square, and the first loop of the fresh one, taking care that the latter falls well over. Take two together, thus, at the commencement of every knitted line, and when the block is made, leave the loops on the needle, and pass to the next square.

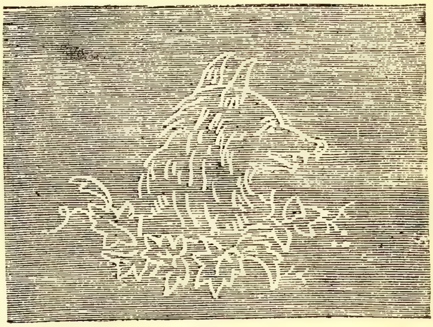
The second and third rows comprise the whole work, and having repeated them as often as desired, make the top straight by introducing triangles, as at the lower edge.

The numerous needles will be found rather troublesome, especially at the beginning of the work. To obviate this drawback each square may be cast off as it is finished, and which does not prevent the stitches from being picked up, just as if the needle were there.

Figs. 3 and 4 show a pair of sprightly designs for handkerchief ornaments, and give an idea of one popular style of ornamenting a gentleman's pocket handkerchief, more especially when their owner is of a sporting turn of mind. Figs. 3 and 4 are each completed by a semi-wreath of foliage, which may be copied in colored cotton or washing silks; the hues chosen according to the deep border which generally frames these handkerchiefs, whether in silk or linen. Naturally the embroidered corner will always be the one that so carelessly, yet so intentionally, escapes

Fig. 3.

from the breast pocket of the fashionable coat. The same taste for animals' heads is noticeable in many other etceteras; a cat or a dog, closely worked in crewel or chain



Fig, 4.

stitch, peers from slippers, handkerchief and tie cases of padded satin, and even scent sachets have lately been decorated with velvet *appliques* of mastiffs, spaniels, etc. The two heads, Figs. 3 and 4, are quickly executed in outlining with the ordinary twist stitch.

— Among the pretty new things are the lamp screens used of late, since lamps began to play so important a part in household life. The screens take the form of oblong or shield-shaped bannerettes, and are hung from silver chased or

gilt standards. A very pretty one has a centre of pale pink satin upon which is painted a small landscape, this is set in a wide frame of grey plush, decorated with a loose drooping spray of wild roses.

— A handsome mantel drapery is made of terra-cotta Japanese canvas, the two ends of which are heavily scolloped. The centre is a piece of deep crimson velvet, upon which a design of sumac blossom is worked in arasene.

— Transparencies are displayed of a material called Miller's muslin, upon which exquisite designs can be worked in long stitch. These transparencies are framed in ebony or ebonized wood, and placed where they can transmit the light.

— Small banner screens for a bracket or mantel are painted in oil colors upon white satin. Carved stands for them can be bought at any fancy store, and the addition of thin white silk cord and tassels makes them very effective.

Prisoners' Pastimes.

BY A. W. ROBERTS.

POVERTY makes strange bedfellows, is an old proverb, and it may with equal truth be said that the pursuit of science makes strange companions.

Little I thought when starting from the New York Aquarium on that particularly exhilerating and sunny Monday morning, that I would, before the day had ended, have accepted the companionship of two professional criminals, one a notorious burglar and the other well—no matter; but so it came to pass. My object was to obtain anemones;* the beautiful dianthus anemone, neither the small long-armed variety, nor the small but exquisitely salmon-colored one so plentiful on the rocky shore of the East River, in the neighborhood of Eightieth Street. No; neither of these would satisfy the ambition and pride of an expert collector. In this particular instance I felt extremely anxious for success, as all the large anemones at the Aquarium had from some unaccountable reason suddenly collapsed. When connected with Barnum's (old) Museum Aquaria the dianthus anemone was plentiful on the rocks about Hell Gate, but within the last twenty-five years numerous oil, gas, acid and other works had become established at Greenpoint, Hunter's Point, and along the shores of Newtown Creek, and hundreds of submarine blastings had taken place at Hell Gate. Turning over in my mind all these facts, and knowing from experience how the rocks along both banks of the river are more or less coated with the villianous materials that pour into the East River from these establishments, it became a question of no easy solution where to obtain the much-desired marine animals. After some deliberation I concluded that my only chance, my only hope, was to visit that renowned, secluded, and very private locality, commonly known as Blackwell's Island. But how was I to get there? That was the rub! I had plenty of letters in my pocket to prove my identity and occupation, not to mention a goodly supply of free passes to the Aquarium, but these were of no use where political influence was the chief, perhaps the only passport to favor. In this dilemma I called to mind that an old friend, whom for short I call "Cush," reigned supreme at the Morgue as deputy coroner, and was well paid for supplying the brains—medical, anatomical and scientific—needed at the coroner's office. I sought him at once, and in a few moments I had obtained two documents, one passing me on to the little steamboat that plys between New York and the lonesome isle, the other introducing me as one of the faithful to the Grand Mogul of the Island of Concentrated Sin. On the island I was passed along from one official to another, and at last into the guard boat. This boat consisted of a well-modeled, red cedar, copper-fastened row boat, containing two prisoners in full uniform of prison clothing. At the stern of the boat sat the guard, silent and som-

* As many of our readers may not be familiar with this curious and beautiful animal, we have prepared a description with elaborate drawings, which will appear in the next issue of the YOUNG SCIENTIST.

bre looking. I tried to take his measure, but could not get behind his rigid physiognomy. The two prisoners rested on their oars; their ages must have been thirty and forty. They were muscular and well appointed by nature in all respects, but on their ruddy and bronzed faces rested that unmistakable shadow peculiar to men in their position. And thus for a minute we remained silent, for we were mutually measuring each other. The guard was first to break the unpleasant silence, by asking "To what part of the island do you wish to go?" I answered "that I did not know exactly, but proposed to examine his side of the island thoroughly for a curious animal that lived on the rocks, called the anemone." Noticing that the name was beyond his mental reach, I made a hasty sketch of an anemone, but he failed to recognize it, although, as he remarked, "he knew every inch of rock and dock on the island, and he feared my search would be in vain." During this conversation the two prisoners remained motionless and silent. I knew they greatly desired to see my sketch, but I dared not hand it to them. "Well," I remarked, "there can be no harm in making a thorough examination if you have no objection." At which remark the slightest suggestion of a smile passed over his set countenance. 'Twas then that I became convinced I had struck his weak spot—vanity—and to a limited extent he was my prisoner and I a free man. Now be it known that in my pockets were numerous packages of both hard and soft tobacco, and my heart was fairly aching to get it into the pockets of the prisoner oarsmen, for next to freedom or money, tobacco is the most prized of all gifts. They chew it; they devour it; in fact, they fairly eat it when they have a bountiful supply, and as they chew they meditate, and as they meditate they chew, and their better natures predominate under the soothing influence of the weed, and in memory they turn back to thoughts of brighter and happier days.

The boat was now heading for the south end of the island, where I proposed to make a landing on a large black rock that projected well out of the water. Taking out of my pocket a paper of tobacco and opening it, I offered it to the guard, and at the same time resolved, that should he partake of it, I would cast the remainder of the paper to the prisoners and tell them to keep it. To my intense satisfaction the guard helped himself to all that he wanted, and returning it thanked me in a kindly way. As I was receiving it I tipped a wink to the prisoner oarsmen, just to prepare them for what might follow. In an instant the tobacco was at their feet, and both oarsmen reached forth for it. This was my grand opportunity; out went four papers of tobacco from my pocket to where they sat, I at the same time remarking, "There boys, no quarreling!" While all this was happening the guard remained passive. Now was the time to make sure of him, as taking a few cigars in my hand I offered them to him, remarking, "There, Mr. Guard, is your share of the 'plunder,' they will help pass the hours away during your 'off time.'" He accepted them, and thanked me. I now felt that my introduction and good standing was thoroughly established, and that I was free to enter into conversation with the prisoners. I had noticed that whenever the boat came to a stand still, one of the oarsmen took from his pocket a long and black object, in which he was deeply interested, and seemed to be busily working on it. My curiosity being excited, I inquired of the guard what he was doing, and was surprised to learn that it was a horse-hair watch guard. Becoming still more interested, I asked permission to examine it, and could not help expressing my admiration, for it was a very unique piece of workmanship, and I wondered the more, as I glanced at his heavy and coarse hands, and calloused fingers, that he could handle the fine horse-hairs with such exquisite skill. Every strand was perfect, and the gradual swelling of the guard from its two small ends to its centre was all that could be desired.

Seeing that the watch-guard was nearly finished, I inquired of him the price, and was informed that it was three dollars, and that it took some two months to

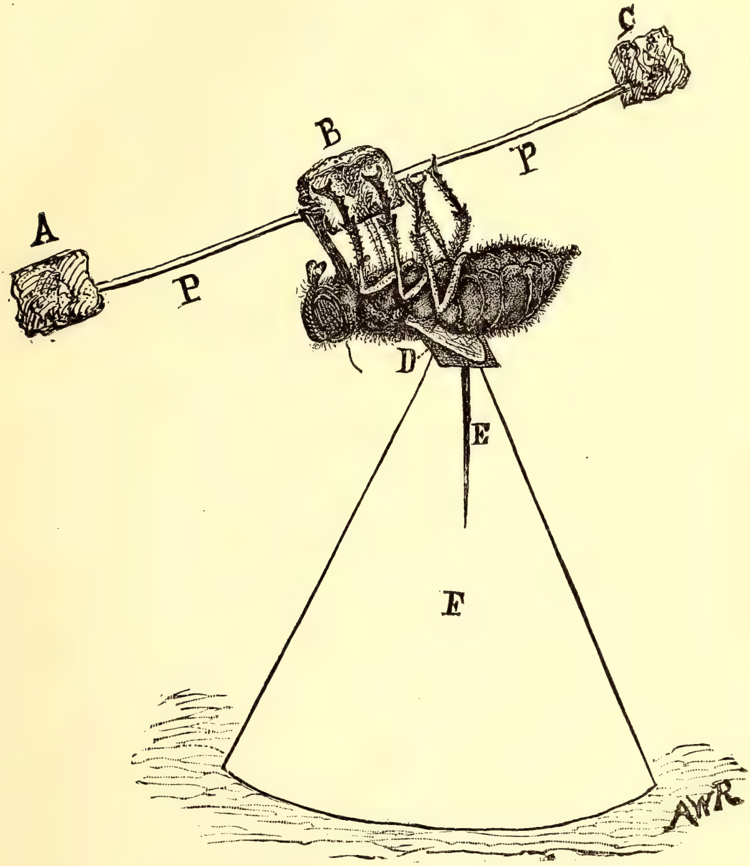
make one, under favorable circumstances. The "favorable circumstances," I imagined, meant the leniency of the river guard and the kindness of the keeper. I would have purchased the one on which he was at work but was informed that he had already sold it. I inquired how he obtained the horse hairs with which to make the guards, and he informed me that friends visiting him always brought a good supply. "Imagining your present occupation and manner of passing away time in your cell was to fail you, what would you do then?" I inquired. "Well, I'd fall back on my performing flies; you see we must have something to occupy our minds, to put a stop to the everlasting recollections of days gone by, and the mistakes and blunders we have made, or otherwise one-half of us would go stark mad. Oh yes; I have passed away many hours in my cell harnessing up and training my performing flies." "Excuse me, but I don't understand what you mean by performing flies," I replied. "Why, didn't you ever hear of or see flies perform with a balancing pole? of course they have to be kind of fixed up or harnessed up, or else they'd be very 'fly'" "No, I confess I have not; it's all new to me; explain how it is done." "Come, now, I'll do better than that; you seem to have plenty of coin, and we exiles are always short on it; I'll sell you my best performing blue-bottle fly and a pure blonde at that, for two dollars, harness and all thrown in. I've had him now for three weeks, and he is sound as a dollar. I'll have him ready for you when you come to the island after more of those enemies!" (I never knew a fisherman, and but very few of the ordinary run of people that I have met, for whom the word anemones was not a little too much. It is always enemies or animies). "All right, it's a bargain. Here, Mr. Guard, you hold the money, then I will be sure that you will not break your promise."

By this time we had reached the black rock, but not an anemone was to be seen. After a general overhauling of the water wall on the east side of the island, I discovered a large number of anemones some eight or ten feet below the surface, but they were well out of reach and almost out of sight; even the guard could not detect them, but to my practiced eye they were quite visible. By this time the tide had become so high that I concluded to abandon all further search for that day. Having obtained from the guard his name and time for going on post next day, I went *home*, not back to the Aquarium. Oh no, I wouldn't do that, not if I had to stay out for a week. What, go back to the Aquarium without anemones? No sir. I mailed a postal card, stating that I had found the anemones, but was having some difficulty in capturing them. That night I made what is known as a "scraper." With one of these scrapers you can peel an anemone from any dock spile or smooth rock, no matter how fast it holds on. All Tuesday morning I was as restless and uneasy, well—as a "fish out of water," so anxious was I to be on my collecting ground. At last I reached the island, and felt happy and jovial when I found myself once more in the guard boat with my new friends. They looked curiously at the scraper, with its mosquito net bag and long, slender handle, and I looked just as curiously at them for some indication of a harnessed-up performing fly.

"Now, Mr. Guard, please take me to the same place, where I discovered the anemones yesterday."

The reader must understand that this part of the island was a retired spot, well out of sight, and I argued that it would be just the place for a private fly performance. Well, to cut this narrative short, after much trouble I obtained a goodly showing of anemones. Now for the fly part of it. The accompanying figure shows exactly how the blonde-headed blue-bottle was "harnessed up," as my prison friend termed it. The performer was a well-fed medium sized ordinary blue-bottle fly with the exception of his head which was of a light yellowish brown color, in fact a pure blonde. To the upper side of his wings a piece of writing paper had been either glued or gummed; after the gum or glue had become dry, and the fly's wings were securely fastened to the paper, the wings and paper had been cut

away to within an eighth of an inch of where the wing joins on to the body of the fly as shown at D in the figure. Through the piece of paper on which the fly's wings were fastened, a long and slender pin passed, as shown at E. This pin entered the apex of the paper cone, F, on which it rested. A thin broom splint from one and three-quarter inches to two inches placed on his legs, which he immediately grasped with his six feet. At times he would spin it around with great rapidity, again he would pass forwards and backwards from one end cork to the other, or he would hold it in a perpendicular position by one of the end corks. Sometimes he would allow one end of the pole to rest on the ground and against the side of the



PERFORMING FLY.

in length, constituted the balancing pole P P. This pole was sharpened to a fine point at both ends, so that it might be passed into the three small pieces of cork, A B C. Now I will try and describe the performance. When the fly was placed in position on the apex of the cone, E, as shown in the figure, the balancing pole was cone, while the other end he retained with his feet; suddenly he would raise the pole and spin it around. When releasing the fly for exercise, and that he might clean himself or have a sun bath, the pin is withdrawn from the paper, or the fly is immersed for an instant in water which soon softens the gum and the fly is free.

THE

Young Scientist.

A Practical Journal for Amateurs.

(With which is incorporated "The Technologist," "The Industrial Monthly," and "Home Arts.")

PUBLISHED MONTHLY AT $1.00 *PER YEAR.*

EDITORS.

FRED. T. HODGSON. JOHN PHIN.

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Our New Departure.

WITH this number the Young Scientist enters upon its SIXTH volume. At the time the first number was issued there was no journal of the kind in existence, and to-day there is not one that covers the same field that we do—a statement which can be truly made of no other journal of which we have any knowledge. The Young Scientist was, therefore, an experiment, and one for which no great success was predicted. Flashy and sensational literature had taken such a strong hold upon the minds of the young, that most of our friends felt that a paper for youth, without "stories," never could succeed. In this, however, they were mistaken, and the present number of the Young Scientist proves it. But, as we have said, the undertaking was an experiment, and its success somewhat doubtful. We were therefore obliged to feel our way, and the Young Scientist has been very far from coming up to our ideal of what such a paper should be. To-day, however, we feel encouraged to take a long step in advance. We have, therefore, nearly trebled the size of the paper; we have provided an amount of important, interesting and necessary illustrations, such as is to be found in no paper which does not use cuts furnished by advertisers, and we have made such permanent arrangements as will not only keep the journal up to the high standard which we have marked for it, but it will secure perfect regularity and promptness.

The principal feature in these arrangements is the addition to our staff of Mr. Fred. T. Hodgson, with whose work all the readers of the Young Scientist are already familiar. His name now appears as editor, in association with my own, and as he will devote his efforts primarily to the Young Scientist, our readers may feel reasonably assured that they have been positively guaranteed against disappointment.

While we hope to made the Young Scientist better and better with each issue, we think we may safely promise that the present number is a fair specimen of what the succeeding numbers for the year will be, with, perhaps, the single exception of the tint inset, a feature which will not appear in every number. But the reader will observe that we have enlarged and strengthened all the old departments, and added several new ones. Our old contributors too have come forward with their best efforts, and Professor Berlin H. Wright, who is deservedly such a favorite with our astronomical readers, begins a series which will continue through the year. But the wider range of subjects which we now include, demands new laborers, of whom we have secured several. We therefore feel certain that every intelligent boy and girl will find matters of permanent interest and value in our pages.

Such extensive improvements, of course, involve greatly increased expenses. The truth is, that our expenses are more than treble, and therefore, we find it imperatively necessary to increase the amount of the yearly subscription. But as we expect a very large accession to the list of our readers, we do not feel obliged to increase the price in the same ratio as the expenditure, and therefore we have fixed the subscription at the even dollar, a sum which is easily sent by mail.

We have long been urged to this step by a very large number of our subscribers, and now we rely upon them to aid us in carrying it out. To those who feel willing to expend a little effort in obtaining new subscribers, simply for the sake of advancing a good cause, we offer the greatly improved journal which such assistance will enable us to give them, while to those who feel that they cannot labor except for a more substantial reward, we offer the very liberal list of premiums which will be found in our advertising pages.

J. P.

Those who have sent in their subscriptions for the Young Scientist for 1883 at the old rates, prior to the issue of this number, will receive all the issues for next year without further charge. So that no dissatisfaction on their part can possibly arise on account of an increase in price of the Journal.

Many boys in Philadelphia have learned to work sheet brass into *repousse*, or raised figure work. Picture frames, shields, medallions, and many other works may be formed by this process, and the art is readily acquired. Many of the boys, who are making a study of the art, are able to earn enough from the results of their labors to pay their expenses while learning. This work is not confined altogether to boys, as many young ladies in the Quaker City have learned the art, and have turned out some very creditable specimens of workmanship.

While confined within the limits of a fifty-cent journal we found it difficult to devote to *interchange* of information as much space and time as we could have wished, and therefore our column of notes and queries became somewhat spasmodic. We now commence a new series with the inquiries which have accumulated during the past few months, and begin with a new series of numbers. Hereafter, all references to answers or inquiries, subsequent to January, 1883, should be by number, and by the *number of this series.* We might also add that we hope our readers, in replying to these queries, will give us the results of their *own* experience, and not merely copy an answer out of some book of recipes. We have all the books of recipes that have been published, and therefore could easily copy such answers ourselves if they were worth copying, which is rarely the case.

Few things fill the heart of an affectionate mother with greater pleasure than to be able to say to her friends and visitors that her Mary or her William made with her or his own hands, this or that little piece of work. Who has not seen a mother's face illumined with justifiable pride when exhibiting to others some piece of fancy needle-work, shell-work, painting, or other specimens of her daughter's artistic skill; and when she is able to point out a cabinet, basket, chair, clock, shelf or any other useful or ornamental article, made by the hands of her boy, her pride is visible in every movement. Now, there is no boy or girl among our many thousands of readers, that is not able to make or work something that will tend to make home more joyous, and at the same time fill their mother's heart with pleasure. Of course it is quite necessary that parents should aid their children to develop their artistic and constructive talents by furnishing them with the instruments, tools, and materials necessary; and by giving them proper encouragement. Many a boy has been saved from pernicious habits and certain destruction by knowing how to use tools.

The singular article by Mr. Roberts, entitled "Prisoner's Pastimes," can hardly fail to attract wide attention. It will call to mind the stories told of famous state prisoners, who, to save themselves from madness, tamed rats, mice, and even spiders. But it teaches a lesson deeper than the mere fact that ordinary men must have something to do to keep the mind from "wearing out its scabbard." We doubt if expert professional criminals ever give their time to such pursuits. It is more probable that they spend their

leisure moments in devising new schemes for plunder, or, as the poet says—

"E'en in penance planning sins anew."

But when the ordinary prisoner, who has not adopted crime as a "profession," leaves the jail, he finds that the work which occupied his mind there is no longer of any use to him, and therefore he is obliged to fall back upon crime in order to maintain his existence. All this points to the great lesson that every man should be taught some useful trade or profession, and that every boy should be encouraged to use his hands as well as his head. Our prison statistics show that very few criminals ever learned a trade. Indeed, a good trade may be said to be the great preventive of crime, and if our prisons are to be anything more than mere houses of punishment, if they are to be made in any sense reformatories, they must become some great trade-teaching schools.

We make no apology for bringing these truths to the notice of our boys. The boys of to-day will be the rulers of to-morrow, and it is necessary that they should be imbued with clear and sound ideas on all these points, and not be at the mercy of demagogues and politicians. It is not the province of the YOUNG SCIENTIST to teach political economy, but when this department of science touches subjects with which we have to do, it would be wrong to ignore it.

One of the greatest difficulties that besets the path of the amateur mechanic is the care and attention demanded by his tools. When a new tool is obtained in good working order, the young amateur is apt to think it should continue to remain in that condition for an unlimited period. We frequently find the first work executed after a new supply of tools has been received, to be of a better quality and finer finish than subsequent productions. It will puzzle many to understand why this is so; but if the tools of the operator should be examined, and compared with the condition they were in when first used, the mystery will vanish, as the tools will be found blunt, out of shape, and perhaps full of small breaks. The "soles," or bottoms of the planes—if of wood—will be found out of truth, twisted, sprung, or hollow transversely; the saws dull, or, if an attempt has been made to file them, the teeth are unequal in length, irregular in size, and filed to all kinds of angles and shapes; the oil-stone will be clogged up with oil and dirt, and the squares, chisels, gauges, and other tools will be found scattered about the workshop or bench in beautiful confusion. The most expert workman can not make good work with tools out of order; he may make good work with inferior tools, as his skill as a workman will enable him to put them in order for the occasion. How difficult, and how discouraging, then, must it be for the young amateur to make fair work, with tools in bad order? Three-fourths of the discouragements that take place in amateur work are the results of using inferior tools, or tools out of order; and we propose to aid the young—and old—amateurs, through the columns of the YOUNG SCIENTIST, to overcome these difficulties, by giving them reliabie information regarding the care of tools, and also of the kind and quality of tools most suitable for their purposes. To accomplish this we have secured the services of a person whose knowledge of the use of tools is very extensive, and who, under the incognito of "Our Ned," will monthly discuss these matters in our columns in a way that may be easily followed by our youthful readers.

Among the Stars.

JANUARY, 1883.

(All Computations are for the Latitude and Meridian of New York City.)

Mercury is brightest as an evening star January 19-22, being at greatest angular distance (18° 32'), east of the Sun on the 22d. He is situated in the 20th degree of Capricornus, 20° S.W. of the λ of Aquarius. The bright star, Fomalhaut, in the Southern Fish, which is further south and sets 19 m. later, will not be as bright. Mercury sets:

	D.	*H. M.*		*H. M.*	
Jan.	15	6 17	eve.	1 19	after sunset.
"	20	6 32	"	1 28	" "
"	25	6 35	"	1 25	" "

in each case 6° 13' north of the sunset point.

Venus has passed to the west of the Sun, becoming a morning star, and 34 days after her transit, or Jan. 9, arrives at greatest brilliancy. She is moving eastward past the stars of the constellation Scorpio, being, at the beginning of the month, only about 10° north of the red star, Antares, and on the last of the month, near the end of the handle of the Milk-maid's Dipper. Venus' phase is a large crescent. She rises on the 10th at 4h. 21m. A.M.; 20th, 4h. 11m. A.M.; and 30th at 4h. 9m. A.M.

Another Transit of Venus will not occur until June, 1996, 114 years hence. The present generation of astronomers must, therefore, be content with the results of the one of last December. Only five transits of Venus have ever occurred of which we have any record; they are as follows: December, 1639; June, 1761; June, 1769; December, 1874; December, 1882.

In 1629 Kepler predicted a transit which occurred in 1631, but it was not seen. He also predicted that of 1761, but he never had the pleasure of seeing his predictions verified; he died only a few days before that of 1631 occurred. From the transit of 1761 a solar parallax of 8″.73 was deduced, which corresponds to a distance of 94,279,932 miles from the Earth to the Sun. The transit of 1874 gave, as a mean of several results, a parallax of 8″.82, corresponding to a distance of 83,492,526 miles. The former transit occurred near the time of the Earth's aphelion, and the latter near its perihelion. Allowing 3,000,000 miles as the difference between greatest and least distances, the distance has been reduced by about 8,000,000 miles. The results of the '74 transit must be nearly correct (a variation in the solar parallax, when placed at 8″.8, of 0″.01 makes a difference of 104,362 miles), and as the results of each successive transit depend upon the computations of the preceding ones, it is quite certain that the transit of last month will give a very close approximation to the truth. It will be several months before the final results will be known.

Mars was in conjunction with the sun Dec. 10, and is now a morning star, but will scarcely be seen this month, rising only one hour before the Sun on the 25th. His satellites will not be seen at all this year, even by the aid of the most powerful telescopes known.

Jupiter was brightest on the 18th of last month, and will be the most brilliant object in the evening skies for many weeks. He is in the eastern part of the constellation Taurus, upon the west margin of the Milky-way, and midway between the two stars *Beta* Aurigæ (2d mag.) and *Zeta* Tauri (3d mag.), which are supposed to mark the tips of the Bull's horns. He is situated in a glorious portion of the Heavens. Just 30° west of him is the large V-shaped figure in the Bull's head known as the Hyades, of which the splendid red double star, Aldebaran, is the lucida. Near by is the Pleiad group or "Seven-stars" (a misnomer, as 12 stars have been seen in this group, and charted, with the unassisted eye, and 499 have been charted, down to the 14th magnitude). Capella and the beautiful little triangle called the "Kids" are north, and Betelguese about the same distance south of him. Orion with its grand array of magnificent objects, is below or south of Jupiter, and Procyon and Gemini east of him.

The celebrated "Crab Nebula" is about 1° south of him on the 26th, which position will be practically retained for several days before and after that date. This will be a good time to look for that interesting object which may be seen with small telescopes. This is the Nebula which the Earl of Rosse resolved into stars with his 6-feet reflector. It looks more like a vast pineapple than a crab, however, with its branches clustering with gems and gold.

JUPITER'S SATELLITES.

The following are the eclipses of Jupiter's Moons which are visible at seasonable hours:

		D.	*H.*	*M.*		
Satellite	II.	1	7	16	even'g.—	Reappearance.
"	I.	2	11	0	"	"
"	III.	4	6	48	"	"
"	II.	8	9	52	"	"
"	I.	11	7	24	"	"
"	III.	11	10	50	"	"
"	I.	18	9	19	"	"

Jupiter's shadow is now projected west of him, but so slightly that the satellites pass from occultations into eclipses without becoming visible, hence the beginning of the eclipses and end of the occultations cannot be seen, transpiring, as they do, *behind* the planet, and the satellites suddenly become visible some little distance west or to the right of the planet.

The early-evening occultations begin as follows:

Occultations.				*Transits.*				
Sat.	*D.*	*H.*	*M.*	Sat.	*D.*	*H.*	*M.*	
I.	2	8	22	I.	3	5	41	ingress.
II.	8	6	5	I.	3	7	56	egress.
I.	9	10	7	I.	10	7	25	ingress.
III.	11	5	44	I.	10	10	16	egress.
II.	15	8	21	II.	24	7	41	egress.
I.	18	6	19	I.	26	7	40	egress.
II.	22	10	40	II.	31	7	19	ingress.
I.	25	8	7	II.	31	10	4	egress.

The transits occurring when the satellites are in the nearer portions of their orbits must occur from left to right, and the shadows *follow* the satellites; the *shadow* of I. beginning its transit 22m., II. 50m.. and III. 1h. 54m. after the respective satellites begin theirs. Jupiter passes the

meridian as follows: 10–10 10 eve.; 20—9 26 eve.; 30—8 44 eve.

Saturn is further west or higher up, and only a few degrees west of the Pleiades. His rings are not seen so well as in August and September, but they are still very fine objects requiring only a very small telescope. We always take a look at him if in sight before leaving the observatory.

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS, JAN. 20, 1883.

	H.	*M.*
Alpha Andromeda (Alpheratz) sets	11	53 P.M.
Omicron Ceti (Mira) variable "	0	5 A.M.
Beta Persei (Algol) variable in merid.	6	56 P.M.
Eta Tauri (Alcyone or Light of Pleiades) in meridian	7	41 "
Alpha Tauri (Aldebaran) in merid.	8	29 "
Alpha Aurigæ (Capella) "	9	8 "
Beta Orionis (Rigel) "	9	9 "
Alpha Orionis (Betelguese) "	9	49 "
Alpha Canis Majoris (Sirius or Dog Star) in merid.	10	40 "
Alpha Canis Minoris (Procyon) in meridian	11	33 "
Alpha Leonis (Regulus) rises	7	18 "
Alpha Virginis (Spica) "	11	55 "
Alpha Bootis (Arcturus) "	10	58 "
Alpha Scorpionis (Antares) rises	4	5 A.M.
Alpha Lyrae (Vega) sets	7	27 P.M.
Alpha Aquillae (Altair) sets	6	15 "
Alpha Cygni (Deneb) "	10	33 "
Alpha Pisces Australis (Fomalhaut) sets	6	51 "

Penn Yan, Yates Co., N. Y.

Polishing Metals.

Soft metals, like gold and silver, may be polished with comparatively soft powders, such as prepared chalk or putty powder (oxide of tin). When metals are to be polished in the lathe the process is very simple. After being turned or filed smooth, the article is still further polished by means of fine emery and oil, applied with a stick, and in the case of rods or cylinders, a sort of clamp is used so that great pressure can be brought to bear on the part to be polished. The work must be examined from time to time, to see that all parts are brought up equally to the greatest smoothness and freedom from scratches, and as fast as this occurs, polishing powder of finer and finer quality is used, until the required finish is attained. In polishing metals or any other hard substances by abrasion, the great point is to bring the whole surface up equally.

A single scratch will destroy the appearance of the finest work, and it cannot be removed except by going back to the stage to which it corresponds, and beginning again from that point. Thus, if in working with a smooth file, we make a scratch as deep as the cut of a bastard file, it is of no use to try and remove this scratch with the smooth file: we must go back, and taking a bastard file, make the surface as even as possible with it, and afterwards work forward through fine files and polishing powders.

Baked Angle Worms.

The *Pall Mall Gazette* (London) gravely reports that a group of French gourmets have tested the edible qualities of the common earth worm, whose agricultural services have been so recently demonstrated.

"Fifty guests were present at the experiment. The worms, apparently lob-worms, were first put into vinegar, by which process they were made to disgorge the famous vegetable mould about which we have recently heard so much. They were then rolled in batter and put into an oven, where they acquired a delightful golden tint, and, we are assured, a most appetizing smell. After the first plateful the fifty guests rose like one man and asked for more. Could anything be more convincing? Those who love snails, they add, will abandon them forever in favor of worms."

Leaf and Fern Natural Prints.

The new process of photographing, known as the "blue process," described in a previous number of this journal, has given rise to a very interesting amateur art—the photographing of leaves and ferns. Fibrous leaves, like those of the maple, oak, poplar, birch, make the best photographs. Hairy, rough, or velvety specimens never prove satisfactory, nor do those that are immature, imperfect, succulent, or have a thick, leathery epidermis. None are better adapted for the experiments of the beginner than fern fronds. After the leaves or ferns have been collected, press and dry them very carefully, for which purpose a botanical press, if judiciously used, is the most satisfactory. Great care is required, lest by too heavy pressure the tender and delicate foliage and finer sprays become crushed, and thus spoiled for printing. Old books and files of newspapers will be found to answer well for the herbarium.

The requisites for leaf printing are neither numerous nor expensive, consisting of two panes of window glass free from bubbles and other defects, and sheets of prepared paper which may now be obtained from any dealer in artists' materials, though if the reader should desire

to make it himself he can easily do so by following the directions previously given.

To make the print, place on one of the panes of glass several folds of tissue paper, and upon these the dried sensitized paper, with the prepared side uppermost. Upon this arrange the leaf or fern, singly or in a group, lay over it the second pane of glass, and secure the whole together with four clips, one at each corner. Place the arranged glasses in the clear sunlight in a secure place, where the fresh air can blow over them. If the day be clear, in about thirty minutes, more or less, the figures will be printed. Watching the paper during the process, you will observe the uncovered parts gradually changing from a yellowish tint to a vivid blue color, the latter deepening into black. When sufficiently tinted, remove the top glass and raise the leaf, when you will find a yellow outline on a deep blue ground. Now wash the paper in several clear waters until the yellow tint bleaches to a clear white; dry with blotting paper, and place under a press. If the glass is removed too soon, the printed picture will be pale and washy in appearance; if exposed to the sunlight too long, the ground will be light, instead of a deep, dark color. Experience alone will teach the proper time of exposure. The printed leaves or ferns ought to be mounted on the left page of an album, writing on the opposite page the common and botanical name, description, habitat, and, indeed, whatever appears interesting in connection with the specimen.

Hard Woods.

Chestnut and butternut are not very extensively sold for finishing, for which the better grades are selected, and their sale is dependent more on the question of taste than real superiority. The poorer stuff is used in common ways, and is best worked off when other woods used in manufacture are scarce in the dry, and the cull's stocks can be employed as a substitute on a pinch.

Basswood is considerably sold for use in furniture.

The black or red birch, which largely resembles cherry, figures somewhat as a finishing wood. The yellow is not valuable in the same way.

Beech enters into the manufacture of chairs, tool handles, brewers' shavings, etc.

Elm is made into cheap furniture.

Yellow pine is very slow in gaining a hold upon popular favor. It is used by a great many operators who speak highly of the lumber, but it is far from having a boom. Generally buyers do not take to it kindly. What is used is mainly for flooring and finishing. Though the boards and planks are a subject of considerable complaint on account of imperfection in manufacture, the flooring is conceded to be turned out in good shape. Where high grade flooring is wanted, yellow pine is regarded the best and cheapest, but where a low or medium grade is desired the wood must give way to white pine. The latter is sold much cheaper than the yellow pine, for when freights are added to the price of the lower grades the yellow pine can hardly compete.—*N. W. Lumberman.*

Scientific News.

— Scientific men in Japan are now discussing the possibility of utilizing the internal heat of the earth. At a recent meeting of the Seismological Society, Mr. Milne read a paper in which he said that the fact that there was an unlimited supply of energy in the interior of the earth had been generally overlooked, although portions of it crop out in countries like Japan, Iceland and New Zealand, in the form of hot springs, solfataras, volcanos, etc. He stated that there is an unlimited supply of water in hot springs within a radius of 100 miles around Tokio, and that the heat of these springs could be converted into an electric current and transmitted to the town.

— The amount of water which passes through the roots of a plant is enormous. Dr. Lawes, of England, has found that an average of 2,000 pounds of water is absorbed by a plant for every pound of mineral matter assimillated by it. At the French Agricultural Observatory at Montsouris it was found that 7,702 pounds of water passed through the roots of the wheat crop for 10¼ pounds of grain produced, or 727 pounds for each pound of grain, in rich soil; while in a very poor soil 1,616 pounds were passed through the same quantity of wheat for a product of about half a pound of grain, or 2,693 pounds of water for each pound of grain.

— An experiment which belongs to the curiosities of science was made quite recently at Paris by Drs. Regnard and Blanchard on a stud of ten live crocodiles which had been presented to M. Paul Bert, late Minister of Public Instruction in France. A crocodile was fixed on a table, and its upper jaw was connected to an overhead dynamometer or powermeter by means of a rope. By startling the animal with an electric current the downward blow of the jaw was measured, and found to be 308 pounds at the point, which, considering the distance of this point from the masseter muscle causing the movement, made the total contractile force of the muscle itself equivalent to 1,540 pounds. This extraordinary snapping power was that of a Saigon crocodile weighing only 120 pounds. An ordinary

sporting dog gave a snap of 72 pounds at the muzzle, corresponding to a contractile force in the muscle of 360 pounds.

— Ordinary vulcanized caoutchouc should contain about 1-10 to 1-6 of sulphur, a greater proportion yielding a hard, horn-like product, which expands considerably when heated. It was established by Mr. Kohlrausch, some years ago, that this hard caoutchouc, while expanding equally with mercury up to the freezing point, expands much more at higher temperatures; so that in a thermometer consisting of a vessel of this material filled with mercury, the latter would appear to contract with an increase of temperature. Results of experiments made by Mr. R. Fuess, of Berlin, appear to confirm Professor Kohlrausch's statement. Mr. Fuess placed a rod of caoutchouc, 1-5 inch thick, in a glass tube, 3-5 inch diameter, and filled the tube with mercury to a height of 3 feet, exactly up to a little pin of platinum projecting horizonitally from the caoutchouc. The calculations from fifteen observations, in which he was assisted by Dr. M. Tiessen, gave an expansion co-efficient of .000082 for each degree C. up to a temperature of 65° F.; higher figures resulting from observations at higher temperatures.

Current Notes.

— A medical man, struck with the large number of boys under fifteen years of age he observed smoking, was led to inquire into the effect the habit had upon the general health. He took for his purpose thirty-eight, aged from nine to fifteen, and carefully examined them. In twenty-seven he discovered injurious traces of the habit; in twenty-two there were various disorders of the circulation and digestion, palpitation of the heart, and a more or less taste for strong drink. In twelve there were frequent bleedings of the nose, ten had disturbed sleep, and twelve had slight ulceration of the mucous membrane of the mouth, which disappeared on ceasing the use of tobacco for some days.

— Without doubt the largest kite in the world was lately made by Dr. Beebee, near Rochester, N. Y. According to the Rochester Express, the frame was made of lumber 2 inches wide by ½ inch thick, and was covered with manilla paper. The surface contained nearly 250 square feet. The string by which the kite was flown was a coil of ⅜-inch rope, ordered from Rochester, and was nearly 5,000 feet in length. To the astonishment of hundreds of spectators, it shot into the air like a balloon. After the monster had floated a mile high for a couple of hours the problem of getting it down was next in order, and was not accomplished until a pulley and team was brought and hauled it down.

— Among the newest Christmas cards are tablets of ivory upon which mottos and quaint pictures are painted. A tiny scent bottle not more than an inch and a half in length, is a novelty. It is made half of thick glass and half of silver; the silver portion screws on over a small glass stopper. It is intended to slip in the inside of the glove, and is made very smooth for that purpose. A heavy piled plush is stamped with a pug's head. It is in a shade corresponding to the background, so that the dog's head, which is clearly defined, seems to be peeping out of a soft warm nest. Many ladies suffering from the antique fever are dipping their costy laces in coffee to give the desired "yellowed with age" look.

— Mr. Dardenne's self-winding clock may be considered to have had a fair trial. A specimen clock was fixed at the Gare du Nord terminus, Brussels, last September, due precaution being taken to avoid tampering with it by affixing the Government seal. After six months' trial it was found in perfect time with the Observatory clock. The clock is wound by a small anemometer or windmill, which is, by a reversed train of multiplying wheels, continually drawing over each wheel an endless chain, in one loop of which the clock weight is supported. As the loop hangs between the clock and the winding machine, the weight is continually drawing through the clock the slack chain drawn up by the wind motor, and thus a constant motion is maintained. A ratchet wheel prevents the motion from turning the wrong way, and whenever the weight is wound right up to the top the motion is checked by a friction brake automatically applied to the anemometer by the raised weight lifting a lever. When the weight is fully raised the clock has a sufficient store of energy to go for twenty-four hours.

— Dr. Franklin invented a stove in 1745. Previous to that time there were stoves in Holland and Germany. Franklin's stove, however, was a great improvement on all that had preceded it. In 1771 he invented several other stoves, one for burning bituminous coal, which would consume its own smoke and had a downward draught, and another intended for the same purpose, having a basket grate or cage, with movable bars at the top and bottom, supported by pivots at the centre, and which, after being filled and kindled at the top, could be inverted, and so made to burn from the base. The next inventor of stoves, ovens, and heating and cooking apparatus, was Count Rumford, who, between 1785 and 1795, devised several improvements, all intended to economize fuel and heat. It may be stated that the box stove now in the State House at Richmond, Virginia, bears date of 1770, is one of the so-called Holland stoves, and was probably imported from England, as the castings, though rude, are superior to the American castings of that day. For cooking purposes Count Rumford's cooking stoves or ranges, lined with fire-brick or soapstone, and with a ventilating oven, which had been introduced into New York as early as 1798, and into Boston about 1800, were gradually coming into use, and between that time and 1825 there

was, considering the period and the obstacles, considerable activity in this branch of manufactures, which has been increasing ever since.

Practical Hints.

— When color on a fabric has been accidentally or otherwise destroyed by acid, ammonia is applied to neutralize the same, after which an application of chloroform will, in many cases, restore the original color. The application of ammonia is common, but that of chloroform is but little known.

Oil Polish for Dining Tables.—One quart of linseed oil to be simmered (not boiled) for ten minutes and strained through flannel; then add an eighteenth part of spirits of turpentine; to be applied daily with a soft linen rag, and wiped off lightly. The only polish that will resist hot dishes.

Bronzing Liquid.—Ten parts of aniline red and five parts of aniline purple are dissolved in 100 parts of 95 per cent alcohol, on the water-bath, and the solution, after the addition of five parts of benzoic acid, boiled (for 5-10 minutes) until it has changed its greenish color to light bronze-brown. Applied with a brush upon leather, metal or wood, the liquid produces a magnificent bronze coating.

Glueing.—French cabinet-makers use a glue-pot with an inside pan made of glazed earthenware and divided radially into three divisions, in one of which is kept strong glue, in another weaker, and in the third water only, with a brush or piece of sponge, for cleaning off superfluous glue from the work. Chalking the joints in glueing end-wood is not to be recommended; a better plan is to size the end-grain with thin glue first, and then make a smooth face before glueing permanently.

Hardening Steel.—For hardening thin steel articles Dr. Hartman recommends: 4¾ qts. of train oil, 2 lbs. of beef tallow, ¼ lb. of beeswax, and 1 lb. of resin. The exact amount of resin, however, is a matter of experiment, always bearing in mind that the greater the proportion of resin the higher the temper. Another mixture recommended on the same authority, is 95 qts. of spermaceti oil, 20 lbs. of tallow, 4½ qts. of neatsfoot oil, 1 lb. of pitch, and 3 lbs. of resin. The pitch and resin are melted, the other ingredients added, and the whole heated until it will ignite if a blaze is brought in contact with it, when it is covered and allowed to cool.

— In the *Polytechnisches Notizblatt*, M. Tilhet's method of copying drawings in any color that may be required or desired is thus described: "The paper on which the copy is to appear is first dipped in a bath consisting of 30 parts of white soap, 30 parts of alum, 40 parts of good glue, 10 parts of albumen, 2 parts of glacial acetic acid, 10 parts of alcohol of 60°, and 500 parts of water. It is afterwards put into a second bath, which contains 50 parts of burnt umber ground in alcohol, 20 parts of lampblack, 10 parts of good glue, and 10 parts of bichromate of potash in 500 parts of water. They are now sensitive to light, and must therefore be preserved in the dark. In preparing paper to make the positive print, another bath is made just like the first one, except that lampblack is substituted for the burnt umber. To obtain colored positives, the black is replaced by some red, blue, or other pigment. In making the copy, the drawing to be copied is put into a photographic printing-frame, and the negative paper laid on it, and then exposed in the usual manner, In clear weather an illumination of two minutes will suffice. After the exposure, the negative is put in water to develop it, and the drawing will appear in white on a dark ground; in other words, it is a negative or reversed picture. The paper is then dried, and a positive made from it by placing it on the glass of a printing-frame, and laying the positive paper upon it, and exposing as before. After placing the frame in the sun for two minutes, the positive is taken out and put in water. The black dissolves off without the necessity of moving it backwards and forwards."

Our Book Table.

The Builder's Guide and Estimator's Price Book. Being a compilation of Current Prices of Lumber, Hardware, Glass, Plumbers' Supplies, Paints, Slates, Stones, Limes, Cements, Bricks, Tin, and other Building Materials; also, Prices of Labor, and Cost of Performing the Several Kinds of Work required in Building; together with Prices of Doors, Frames, Sashes, Stairs, Mouldings, Newels, and other Machine Work. To which is appended a large number of Building Rules, Data, Tables and Useful Memoranda, with a Glossary of Architectural and Building Terms. By Fred. T. Hodgson, Editor of "The Builder and Wood-Worker"; Author of "The Carpenter's Steel Square, and its Uses," Etc., Etc. 1 vol., 12mo., cloth, gilt. Price, Two Dollars. New York: The Industrial Publication Company.

The scope and character of this work are so fully set forth in the title that nothing need be said as to its contents; they speak for themselves, and at once commend the volume to those who are seeking for the information which it contains. But as regards the execution of the book a word or two may not be out of place.

The value of a volume of this kind will depend upon three things: First, the need which exists for such a book; secondly, the good judgment that is exercised in selecting the information that is given; and thirdly, the fidelity and care with which the work is done.

As regards the need for such a book there can be no question. Every architect, contractor, builder, and even every country carpenter, feels the need of just such a book as that before us. Several attempts have been made to supply the

want, but they are all very defective, and although the present volume may not be perfect it is certainly a great advance over any of its predecessors. That it contains just the information that is needed by those for whom it is intended, is guaranteed by the well known reputation of the author, who has not only had extensive practical experience in the matters to which the work relates, but has, through his position as editor of the *Builder and Wood-Worker*, been brought into intimate contact with the very persons to whom the work addresses itself.

Bearing these facts in mind, we have gone carefully over its pages and tested by actual calculation, many of the rules and results given. In every case we have found them correct, thus proving the painstaking fidelity of the author. A work of this kind, to be of any value must be above suspicion as to the accuracy of its contents, and from the careful examination which we have given it, we believe that the present volume is as nearly correct as it is possible to make such a book.

The work forms a handsome volume of nearly 350 closely printed pages, and we feel confident that it will find its way into the library of every one who is practically interested in the art of building—not only professional men, but intelligent house owners who desire to check the estimates handed in by builders and others. J. P.

Hints on Estimating. Chas. D. Lakey, Publisher, New York. Price, nine cents in stamps.

To the amateur who wishes to build a barn, fence, stable or workshop, this little treatise will be of great service, as from it he can find out the cost of the structure before he commences work. To the regular carpenter or joiner, it will prove an invaluable aid in assisting him to arrive at the costs of the various works he may be called upon to erect or value.

The Metal Turner's Handbook. By Paul N. Hasluck. Published by Crosby, Lockwood & Co., London, Eng.

This is a little work of some 150 pages, divided into fifteen chapters, two only of which may be said to be of any real service to the amateur metal worker—i.e., the one on the slide-rest, tools and cutter-bars, and the chapter on tool grinding, and even these are more descriptive of appliances than of the manner of operation. The remaining thirteen chapters are devoted more particularly to descriptions of the various makes of English foot-lathes, slide-rests, and lathe tools of several kinds, and one chapter is devoted altogether to the dimensions of small motors. Indeed, from our point of view, the work partakes largely of a manufacturer's descriptive circular, or rather of a number of them, bound in one cover, as the one hundred and fifty illustrations contained in the work are evidently taken from makers' catalogues. We do not know that this lessens the value of the work, but we are inclined to think these illustrations and the accompanying descriptions, are not altogether in place in a small book with a title similar to the one before us; or, in other words, the title of the book is misleading; it is the play of Hamlet, with very little of Hamlet left in. Notwithstanding its misleading title, the book possesses merits as a guide in some departments of metal turning, particularly so in the chapter on overhead gearing, and many hints and suggestions are offered regarding the construction and management of these useful additions to the foot lathe. To anyone about to purchase a lathe this book will prove valuable, as it will give the intending purchaser some "points" with regard to the construction and capabilities of different kinds of lathes, that may be of service to him.

Taking it all in all, while we cannot recommend the book to our younger amateurs, we have no hesitation whatever in saying the work will be serviceable to the advanced amateur and all who desire to be well posted on the foot-lathe.

The Builder and Wood-Worker. For Architects, Cabinet-Makers, Stair Builders, Carpenters, Car Builders, etc., etc. Published monthly by Chas. D. Lakey, 176 Broadway, New York.

The December number of this excellent journal is at hand, and as usual, it is full of good things. When we look over its pages and observe the large number of very costly illustrations which it contains, we are astonished to find that the publisher has reduced the price from $1.50 to $1.00, and this is to be accounted for only by the fact that the circulation has increased to an extent very unusual with strictly technical journals. As it now stands it is unquestionably the cheapest journal of its class of which we have any knowledge. Much of this success is due to the fact that the *Builder and Wood-Worker* is of great value not only to professional architects, carpenters and builders, but to every intelligent owner of a house, as its columns afford innumerable hints for improving our dwellings in the direction of convenience, healthfulness and beauty. No house-holder can invest a dollar to better advantage than by subscribing for the *Builder and Wood-Worker*. It will repay its cost ten times over in the practical "wrinkles" which it contains.

Something about Gift-Books.

The holidays are at hand, the days on which congratulations are given and received, and on which are made those little gifts that do so much towards tightening the bonds of affection and love that should always exist between friends and relatives. Among these gifts, books always take a prominent place, and we therefore take this opportunity to give such information on this point as we may collect, so that intending purchasers may be able to choose their books with some idea of what they are to get. We take pleasure, therefore, in submitting the following

notices of holiday gift books, with prices, titles, and remarks:

One of the best books on the list suitable for a boy, is a copy of the new edition of Addison's masterpiece, *Sir Roger De Coverley*, just published by D. Appleton & Co., Bond street, New York. Price, $2.25. The book is handsomely bound and contains 125 illustrations, and has a fine steel etching as a frontispiece.

Another good book, suitable for either boys or girls is the *Magna Charta Stories*, a collection of tales of heroism, edited by Arthur Gilman, A. M. The tales recounted in this volume are presented to their readers with the intention of showing to a certain extent the persistence with which the idea of freedom has been pursued through the centuries, from the mythical age of Horatius to the time of King John, of England. It is not an endeavor to give a history of freedom, but a presentation of the notable instances in the world's history in which men have made their lives memorable in resisting oppression and breaking the bonds of the oppressor. The fact that a number of authors have labored together under the general supervision of the editor, gives the book the advantage of presenting its subject in a variety of lights. While adhering closely to the historical truth, the sketches are all written in a lively, entertaining style. Whether it be merely a coincidence or not, the fact is, that all the papers contributed are, with the exception of the editor's, written by women. Harriet D. Slidell McKenzie, Amanda B. Harris, Mary Blake, Lizzie W. Champney, Susan Coolidge, Mrs. M. E. Sherwood, Anne Laurens Dawes, Mrs. Rose Hawthorne Lathrop, and Mrs. M. H. Catherwood, have contributed the following articles: "The Great Paper," "Horatius at the Bridge," "A Successful Secession," "Two Immortal Names," "At the Toe of the Big Boot," "The Triumph of an Idea," "The Hammer of the Gentiles," "The Barbarian's Overthrow," "The Hammer of the Saracens," "Miltiades at Marathon." "In the German Woods, Long Ago," and "Out of the Dark," are by the editor. A list of authorities is added at the end of each paper, so that the youthful reader can pursue the subject further, if so inclined. This is published by Lathrop & Co., Boston.

A most excellent book for boys between ten and sixteen years of age, is Z. R. Bennett's *A Young Vagabond*, published by J. S. Ogilvie & Co., 31 Rose St., New York. This is just the kind of book boys like to read, and though full of stirring incidents and interesting anecdotes, it does not contain anything that will tend to corrupt their taste or morals, and the illustrations, of which there are a number, are not calculated to vitiate their ideals of life. The work is well bound in cloth and contains 265 pages. Price, $1.00.

A book adapted for the smaller children, boys or girls, is the *New Games for Parlor and Lawn*, by George B. Bartlett, a collection of social games, pleasantly and clearly explained by the author. The charades are so simply arranged that children can easily prepare them for home amusement, and some new changes in old games are suggested. This work is published by the Harper Brothers, New York. Price $1.00.

Another good work for either boys or girls is Dicken's *A Child's History of England.* This is a standard work, and is likely to remain so for all time, and we do not know of any work of the kind we can recommend to our young reader in preference. The American News Co. have issued a fine illustrated edition of this work, covering nearly 500 pages; it is well bound in cloth. Price, $1.25

The fourth part of *Adventures of Two Youths in a Journey to Egypt and the Holy Land*, by Thomas W. Knox, published by Harper Bros., is a seasonable book just adapted for enterprising boys. The author's method of putting the narrative in the mouths of boys is a happy one, and his books are descriptive of countries that had before been neglected by juvenile writers. He has also the art of presenting information so attractively that he has not resisted the temptation to make his volumes very large. The book is illustrated, and contain 438 pages. Price, $3.00.

Two books published by the Scribners' may also be mentioned as making very appropriate gift-books. The one by James Baldwin, *The Story of Siegfried*, is especially adapted for boys, indeed it is the first successful effort to open up to young readers that wonderful world of the Nibelungen Legend, from which they have hitherto been shut out by a lack of the learning that would admit them. They have had either to take feeble versions of the great story, or wait until the time when they could read it understandingly in its fullest form—a time too late to give them the keenest enjoyment of the adventures of Siegfried, the Dragon-Slayer, and the heroes and traitors, giants and dwarfs and monsters, who fought with or against him in that marvellous and almost endless struggle. The work is handsomely illustrated. Price, $2.00.

The other work, *The Ting-a-Ling Tales*, by Frank R. Stockton, will be sure to please the girls both with its illustrations and funny tales. It is full of enchanting sorcery and fairy-pranks, fantastic, grim, preposterous, fanciful, astonishing, quaint, by turns, and always brimful of humor—a peculiarly sly and irresistible humor, of which Mr. Stockton alone has the secret. Price, $1.00.

My Household Pets, by Theophile Gautier, is a desirable gift-book, and will no doubt gladden the hearts of many little ones these coming holidays. Gautier's tender descriptions of his cats—the white and the black "dynasties"—dogs, mice, chameleons, magpies and horses, which owe their charm to his happy style, are sympathetically translated in this neat volume. The work is published by Roberts Bros., Boston. Price, $1.25.

Notes and Queries.

In continuing this department, which has been found of so much value, we would remind our readers who wish for information on any of the arts and sciences, that they are cordially invited to make their wants known through this column, and those of them who can furnish accurate answers to questions asked are requested to send in replies. Doubtless, many of our subscribers may know of methods, processes, or devices that may be better or more suitable for the particular case in question than anything generally known, and it is this reason that induces us to keep this department open for a medium, when an interchange of ideas and practices may be made to the advantage of all our readers. Correspondents will please send their full address when forwarding their communication—either questions or answers—not for publication, unless expressly so stated, but so that we may know where to find the writer if desirable

1. R. G., Newark, N. J.—(1) What is meant by "Cathay" and a "Cycle of Cathay?" (2) Who wrote the "Swiss Family Robinson?"

2. S. N., Hartford, Conn.—I desire to dry and cure some skins, and would like some reliable information on the subject, and if some reader of the YOUNG SCIENTIST will help me I shall feel under obligations?

3. VICTOR, Jersey City, N. J.—Can you inform me what combination of woods is the most suitable for inlaying, where the figures are to be simple and of a kind that an amateur of two years practice can master?

4. NELLIE, Denver.—What materials used, and how applied, for bleaching skeletons and leaves?

5. R. T. Augusta, Me.—I should be pleased to know through this column, why it is that the leaves of trees change their color in autumn?

6 J. N., Philadelphia.—I have heard or read of a table or window fountain that required no outside pressure or "head" other than was contained in the fountain itself and that would play from thirty to forty minutes at a time without recharging. Does any fellow reader know anything of it, and if so, will he kindly give publicity to his knowledge in these columns?

7. REUBEN W., Andover, N. Y.—I am desirous of purchasing a scroll saw, one that will do fine work, and one that may be used for cutting thick stuff—say from one to two inches thick. Now what I want to know is, where can I get such a saw, and can you recommend any firm from whom I can purchase?

NOTE. With regard to the above we may say there are a number of excellent saws in the market, any one of which would answer the purpose sought. We cannot recommend any particular firm to buy from, but we may say that perhaps the saw most suitable for thick and thin stuff is the $20 one manufactured by John & F. Barnes. For very fine work, however, we should prefer the "Lester," or the "Challenge," either of which can be made to do exquisite work when properly handled. We may be able next month to refer you to our advertising pages for reliable firms from whom you can purchase what you want for scroll sawing purposes.

8. "BIG BOY," Utica, N. Y.—I wish to learn amateur carving, will the YOUNG SCIENTIST inform me where I can get any real practical information on the subject?

NOTE.—Books on carving, suitable for amateurs are very scarce, yet there are a few that may be recommended, though they do not, singly, cover sufficient ground to satisfy the wants of a beginner in the art of carving. "Leland's Wood-Carving Manual," price 36 cents, is a very good work and is purely American. General Seaton's "Wood-Carving" is perhaps a better work than "Leland's," as the General himself was an amateur, and wrote his work from an amateur's stand-point. The work is an English one and costs $1.00. There is also another English work by Alfred Rogers, the "Art of Wood-Carving," but it is scarcely obtainable here. Prof. Ben. Pitman, of the Ohio School of Design, Cincinnati, has written a work on wood-carving, which we dare say goes into the subject pretty thoroughly. We have not seen the work as it is scarcely yet in the market. If you write Mr. Pitman as above, he may give you some information regarding it. We intend shortly to begin a series of illustrated articles on the subject in the YOUNG SCIENTIST, in which an endeavor will be made to cover the whole ground of amateur wood-carving. You can learn more, however, by watching some practical workman for a few hours than you can learn from books in a month; and we would advise you to make it a point to visit some place where wood-carving is practiced, so that you may be enabled to see for yourself how the various operations are performed by regular workmen.

9. F. E. F., Lancaster, Pa.—If you will allow me to suggest something which I think would be appreciated by a large number of your readers. I would say that a few illustrations of monograms now and again in the YOUNG SCIENTIST would be quite acceptable. I would like to get a monogram of my initials, for instance, and I am sure there are many readers like me, who would be pleased to get their monograms?

NOTE.—Now, this is just what we want—suggestions—and we hope more of our readers will help us in this way. As regards "monograms," we have already intended to do something in this direction, but did not know exactly how to go about it. Your suggestion has relieved us considerably, and we will now make it a point to illustrate to a limited extent, such monograms as our readers may desire, and we shall be pleased to receive drawings of combinations from our readers who will furnish the same. Remember, that all drawings sent to the YOUNG SCIENTIST must be made in good black ink or pencil, on clean white paper.

10. S. O. G., Savannah, Ga.—I am sometimes puzzled to know what is meant by the word æsthetics; it seems to be used for so many purposes. Will you kindly inform me what the correct definition is?

Market Report.

Price-List of Pet Animals, etc.

All young persons, at some time or other develop a fondness for living pets of some kind. Boys frequently evince a strong liking for ponies, dogs, rabbits, squirrels and similar animals, while the girls delight in caring for little dogs of fine breeds, cats, birds and aquarium fish of all kinds. This trait in young people is a laudable one and worthy of encouragement, as it cultivates a feeling of kindliness and good will towards animals in the minds of young people, that might otherwise remain undeveloped. In order to inform our youthful readers of the prices paid for pet animals we have arranged a price list by which the retail cost of any animal may be seen at once. These prices, it must be understood, are the selling ones for the city of New York and neighborhood, but we do not think they will vary much from prices given in other large cities.

Of course, our readers are aware that there exists a large difference between the retail and wholesale prices—sometimes amounting to one-half or more; this difference is but just, as the dealers sometimes have to keep and care for the animals a long time before getting any returns, and frequently deaths take place, losses against which the dealer must insure himself by making the difference between the wholesale and retail price sufficiently large.

This price list or amateur "Market Report" will be continued from month to month and will be enlarged and corrected from time to time in accordance with the changes in actual prices. We will also try to give early mention of any novelties that may be worth noting.

IMPORTED CAGE BIRDS.

Canaries, *Belgian*, per pair	$3.00 to 15.00
" *French*, each	8.00 to 15.00
" *German, Hartz Mts.*, each	2.50
Gold Finches, each	$1.50
Gold Finch (mules), each	2.50 to 5.00
Bull Finches, each	1.50 to 2.00
Bull Finches (tuned), each	5.00 to 30.00
African Finches, per pair	2.50 to 5.00
Chaf Finches, each	1.50
Linnets, each	1.50 to 2.00
Linnets (mules), each	1.50 to 2.00
Green Linnets, each	1.50
Java Sparrows (blue), each	1.50
Java Sparrows (white), each	3.00 to 4.00
English Sparrows, per pair	1.00
Siskins, each	1.00
Gray Cardinal, each	5.00
Nightingales, each	8.00 to 25.00
Thrushes, each	5.00
Skylarks, each	5.00
Troopials, each	5.00 to 15.00
European blackbirds, each	5.00
Black-caps, each	4.00
Starlings, each	2.50 to 50.00
Ring Doves, each	

AMERICAN CAGE BIRDS.

Canaries, each	
Mocking Birds, each	$1.00 to 10.00
Robins	2.50 to 50.00
Blue Birds ("Blue Robins") each	$1.50 to 2.00
Indigo Birds, each	1.00
Nonpariel, each	1.50 to 2.00
Virginia Cardinal, each	2.50
Bobolinks, each	1.00
Yellow Birds, each	1.00

QUADRUPEDS.

Terriers, *black and tan*, each	$5.00 to 30.00
Terriers, *Scotch and Skye*, each	5.00 to 30.00
Newfoundland Pups, each	10.00 to 15.00
Pomeranian or Spitz "	5.00 to 15.00
Greyhounds, *English*, "	10.00 to 25.00
Greyhounds, *Italian* "	10.00 to 30.00
Guinea-Pigs, *common*, per pair	1.50
Guinea-Pigs, *all white*, "	2.00
Guinea-Pigs, *African*, "	3.00
Squirrels, *gray and black* "	3.00 to 10.00
Squirrels, *all white* "	15.00 to 25.00
Squirrels, *flying* "	3.00 to 4.00
Squirrels, *small red* "	2.00
Rabbits, *common* per pair	1.00 to 2.50
Rabbits, *fancy breed*, according to age and purity of breed, per pair	3.00 to 15.00
Ferrets, *English*, "	15.00
Raccoons, each	4.00 to 5.00
Cats, *Maltese* (males), each	5.00
Cats, *Albinos, pink or blue eyes*, each	3.00 to 5.00
Rats, *white China, pink eyes*, per pair	1.50
Rats, *piebald*, per pair	1.50
Mice, *white, pink eyes*, per pair	0.50
Mice, *piebald*, per pair	0.50

Nature has her language and she is not unveracious, but we don't know all the intricacies of her syntax just yet, and in a hasty reading we may happen to extract the very opposite of her real meaning.

Wood-carving is an industry which is carried to considerable perfection among the Germans, and is fostered by the establishment of carving schools, particularly in districts where the wood used for the work—Spanish walnut, the best walnut the Germans have—is plentiful. There are now 80 such schools in Germany.

Speed of Cannon Balls.—The highest velocity that has been imparted to shot is 1,626 feet per second. This is equal to a mile in 3.2 seconds. The velocity of the earth at the equator, due to rotation on its axis, is 1,000 miles per hour, or a mile in 3.6 seconds. Therefore if a cannon ball were fired due west, and could maintain its initial velocity, it would beat the sun in its apparent journey round the earth.

How Small Birds Migrate in Europe.—According to a writer in *Nature*, the small migratory birds that are unable to perform the flight of 350 miles across the Mediterranean Sea are carried across on the backs of cranes. In the autumn many flocks of cranes may be seen coming from the north, with the first cold blast from that quarter, lying low and uttering a peculiar cry, as if of alarm, as they circle over the cultivated plains. Little birds of every species may be seen flying up to them, while the twittering songs of those already comfortably settled upon their backs may be distinctly heard. But for this kind provision of nature, numerous varieties of small birds would become extinct in northern countries, as the cold winters would kill them.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business matter in letters or cards they are filed away and never reach the printer.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

Wanted engraver's tools with book of instructions, for a Victor Press, with cabinet, 2 type cases, type, ink roller and furniture complete; perfectly new. L. Warren, 72 Cumberland St., Brooklyn, N. Y.

A Fletcher Foot-Blower, cost $5, as good as new; will exchange for a Cushman, 2 in. or up scroll chuck, or other make; will give a satisfactory trade on the difference in price, if any. Louis Lutz, St. Clair Street, Toledo, O.

I have a lot of "Galaxy" (magazines) which I would like to exchange for an air rifle in good condition, a collection of birds' eggs, or offers. W. B. Greenleaf, 480 La Salle Ave., Chicago, Ill.

I have a Mechanical Telegraph with book of instructions, books, etc., which I wish to exchange for good microscopical objects, mounted on 3 x 1 slips. Address, with list, J. H. Frey, Millersburg, Ohio.

To exchange, "How to Use Microscope," Wells' "Natural Philosophy," and many other books, chemical apparatus, etc , for good photographic camera, and lenses. W. H. Weed, 254 Putnam Ave., Brooklyn, N. Y.

Wanted "Quimby's New Bee Keeping," for "Our Own Birds of the United States," by W. S. Baily; new. Joseph Anthony, Jr., Colota, Whiteside Co., Ill.

Wanted a good book in anatomy, in exchange for a book on chemistry, or for story books. A. G. G., Box 26, Summit, New Jersey.

A German-silver trimmed, patent lined, cocoa flute, cost $4, in good order, for good spy-glass, photo-material, or offers. Ewing McLean, Greencastle, Ind.

I have some fossil shells from the west bank of the Mississippi, to exchange for Indian relics. A. W. S., 187 E. 71st St., N. Y.

I have a magic lantern, Ruby pattern, nearly new, and 5 views; also "Our First Century," bound in leather, cost $7; state what is wanted in exchange. I. N. Spencer, Box. 217, So. Manchester, Conn.

First-class telegraph instrument and attachments, and "Wood's Botany," for bound volumes of periodicals, books, or offers. H. P. Albert, Anderson, Iowa.

Wanted a book on treatment and care of canary, also breeding of same; will give in exchange book named "Market Garden, Flower Garden and Bees," or 40 "Scientific Americans" or "Seaside Libraries;" want also old books. M. J. Mulvihill, Norwalk, Conn.

Coins, minerals, stamps, books, type, fishing tackle (very complete) and fish pole, bronze inkstand, etc., for coins, medals, stamps, war envelopes, old newspapers, and Continental, Colonial and Confederate currency. F. F. Fletcher, 103 Main St., St. Johnsburg, Vt.

Blow-pipe set (cost $10), large illustrated family Bible (cost $7.50), for Wood's Botany, Dana's Geology, or printing press and type. H. W. Noble, Box 134, South Dansville, N. Y.

Wanted, offers for fossil shells from the west coast of Africa. A. W. Seward, 187 E. 71st St.

I have a number of birds' eggs I should like to trade for other birds' eggs; send for list of trading eggs. A. G. G., Box 26, Summit, New Jersey.

For a microscope stand or offers, a 36-inch turning lathe (new) and a number of scientific books; send for list. A. Kendall, Somerville, Mass.

Wanted services of amateur printer with small office (or large), in exchange for an interest in a well-established weekly paper, good size. Eagle Office, Plymouth, N. H.

American Agriculturist microscope, new, cost $15, for amateur photographic apparatus, lever watch, 22 calibre breech-loading sporting rifle or magic lantern of equal value. Wm. A. Walker, Rockland, R. I.

I. T. Bell, Franklin, Pa., has back numbers of Scientific American, Forest and Stream, and Young Scientist, good flute, chessmen, books, etc., for good magic lantern, revolver, scarce coins, or offers.

A steel spring bracket-saw, 2 doz. saw blades, and about 1 doz. patterns for a good stylographic pen or offers; send postal before exchanging. Geo. Oakley, Rutherford, N. J.

A rosewood banjo, 11 inch head, 12 nuts, fully strung, together with lot of dime banjo music and instructions, for microscope, Webster's Unabridged, monkey, squirrel and cage, or offers. J. DeWitt Clark, P. O. Box 37, Brooklyn, N. Y.

For self-inking printing press and type, one Henry rifle, 16 shot, 44 cal., cost $40, in good order, or one double barrel shot gun, barrels London fine twist, or offers. J. B. Garrison, Belton, Bell Co., Texas.

What offers for "The Chefs D'Oeuvre D'Art, Paris Exhibition 1878," cost $16, good as new, bound; 1 large photo camera, complete, cost $95; Scientific American from 1859 to 1880, 4 vols. bound. D. Keesler, Stony Point, N. Y.

Sea shells of Atlantic coast, scientifically marked, for books, old or new magazines, Indian relics, natural history specimens, apparatus; anything. Wilfred Leon Miller, P. O. Box 392, Cape May, N. J.

A new 40 diameter microscope, corals, and minerals, for a stylographic pen, air gun, or offers. J. McBride, 54 Garley St., Chicago.

A dulcimer that cost $20, books and fossils, for a telescope, microscope, fossils, Indian relics, or offers. E. J. Votaw, Salem, Iowa.

A self-inking model press, 5 x 7½, cost $23; $90 worth of scroll-saw designs in lots to suit; Scientific American, 1880; Palliser's Useful Details, $3; for photo outfit or offers. C. H. Parker, Coldbrook Springs, Mass.

Telegraph key and sounder, Frank Leslie's Illustrated Magazines, mounted microscopic objects, natural curiosities, for bull's-eye condenser, photograph camera, Unabridged Webster Dictionary, or offers. W. T. Alan, Greenville, Mercer Co., Pa.

Large magic lantern, spectroscope, pantagraph, for enlarging drawings, rosewood writing desk, man's saddle, for microscope, photo outfit or offers. Thomas Walters, Bergen St., East of Brooklyn Ave., Brooklyn, N. Y.

Model card press, chase 3¼ x 5¼, with 4 fonts type, cases, etc., for good foot lathe. Mills Day, 2 Farmington Av., Hartford, Ct.

French microscope, inclines to any angle, delicate fine motion, neat upright case, cost $17.50, for scientific books; send list to W. Fitz, P.O. Box 2852, New York.

Wanted, Quinby's New Bee Keeping, for Our Own Birds of the United States, by W. S. Baily; new. Joseph Anthony, Jr., Coleta, Whiteside Co., Illinois.

Printing type, small pica; large and small capitals, and small letters; 60 to 65 lbs., including two large cases; also gothic nonpariel, for trade. J. Siler, 1242 Broadway, St. Louis, Mo.

One years' copy of Aldine, cost $5.50, and German accordion, with instructions how to use it, cost $5.00, for offers. Chas. Dempwolf, 86 Benson St., Paterson, N. J.

A Novelty printing press, with type, prints a form 5 x 7 inches, cost $40.00, for a microscope, photographic apparatus, or offers. T. W. Patterson, Warsaw, N. Y.

$80 worth of (nearly new) printing material, minerals, fossils, Aboriginal relics, etc., for scientific books, good American watch, and offers. F. M. Farrell, Cobden, Union Co., Ills.

Rocks, minerals, fossils and fresh water shells for microscope stand, $20 to $75, also for objectives, turning lathe type, and tools. D. D. Babcock, South Dansville, N. Y.

Magic lantern, in good order, condensing lens, 2½ in. diameter, 8 slides. For small photographic camera or offers. H. A. Giddings, 4 Union Place, Classon Ave., Brooklyn.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

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Why and How We are Enabled to Cut One Metal with Another.

BY JOSHUA ROSE.

SOME philosopher has said that the degree of civilization of a people could be measured by their consumption of iron. It is true that as nations progress they increase the employment of iron in the constructive arts. But the age of iron, as the era of iron consumption has been termed, promises to be succeeded by an age of steel, because it is steel that has enabled us to cut and shape iron so quickly as to enable it to be made and formed so cheaply that it could compete in price with wood and stone in the construction of buildings, and with wood in the construction of vehicles and other articles where lightness as well as strength is a necessity. The steel of which I desire more particularly to speak is known by the general name of cast-steel, and more definitely by the name of tool-steel, since it is the special grade or kind of steel from which cutting tools are made. But even this kind of steel is made in many different grades or kinds, according to the purpose for which it is to be used. It is sufficient for our purpose, however, to state that the cutting quality of steel is due to its being harder than other metals, and to the fact that by a simple process it can be what is termed *hardened*, which means given an increased degree of hardness.

This process consists in heating it and then suddenly cooling it, and the degree of hardness depends upon the degree to which it is heated and the suddenness with which it is cooled after being heated.

The harder the metal it is to cut the more the steel must be hardened. For example, if we take a piece of steel and cut it into two pieces, and then heat one piece red-hot and quench it in water, it will cut the soft piece. Suppose, now, that we take the hardened piece and again heat it to a red heat and then per-

mit it to cool slowly, and it will have become soft again.

The highest degree to which a piece of steel may be hardened is attained by heating it to a red heat and cooling it in mercury, but it is not found necessary to use mercury for the cooling process in the case of any ordinary metal-cutting processes, because salt water and generally pure water is found to extract the heat sufficiently quick to make the steel hard enough. Between this degree of greatest hardness, however, and the degree of greatest softness of any piece of steel, there are a number of degrees of hardness that are known by the term, *temper*, and a piece of steel is tempered when it is given any degree of hardness above that it possesses as it is in the forged bar and less than its greatest degree of hardness.

All cutting tools that are not left fully hardened are tempered to a degree that has been found most desirable for the purpose for which the tool is to be used.

The necessity for tempering a tool arises from the fact that hardening a piece of steel decreases its strength and makes it brittle, while for many cutting purposes strength in the tool is a necessity, as is the case with a knife blade. The cutting edge of a knife would last much longer if the blade was fully hardened, but that would weaken it so much that it would break very easily; hence it is first hardened and then tempered, the tempering process consisting of heating it to some degree less than that to which it was heated to harden it, and serving to restore the strength that was lost in the hardening. The object is thus to give to every tool as much hardness or as great a degree of temper as possible, while having it strong enough for its cutting duty. In order that the degree of temper may be uniform for a given purpose it is necessary that (supposing them to be all made from the same quality and grade of steel) they all be heated to the same temperature for the hardening process, and then reheated to the same degree for the tempering process. It may be remarked, however, that a variation in the heat for the tempering process is a greater detriment than one in the heat for the hardening, because the effect upon the steel is greater.

Fortunately, however, Nature has given us an excellent gauge whereby we can know to a certainty how much a piece of steel is heated so long as its temperature is not greater than 600 degrees or less than 000 degrees, and it is between these two temperatures that the degrees of temper for all cutting tools is obtained.

If a piece of steel, either hardened or quite soft, have its surface brightened and is slowly heated, it will, when it is heated to 600 degrees, assume a yellow color. As it becomes more heated the yellow deepens, until it passes to a red; from that it passes (as the steel gets still more heated) through various shades of purple, then to blue, and finally to a very pale blue, with a slight green tinge, which appears when the steel is heated to 000 degrees.

It is clear, then, that if a piece of steel has been hardened, we may know how far its tempering has proceeded; or, in other words, to what extent we have at any point of time reheated it by the color that

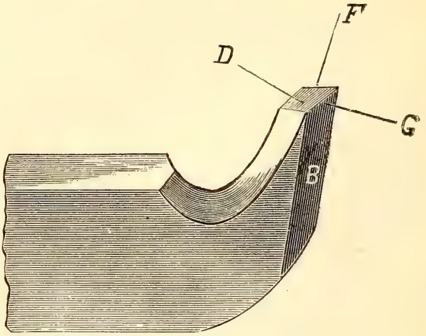


Fig. 1.

has appeared upon its brightened surface. Hence this process is termed color tempering.

Now, since the colors will appear upon soft as well as upon hardened steel, their appearance does not tell us anything more than that it has been heated to a certain degree, and that if the steel had been previously hardened, then it is tempered to a degree corresponding to the color on its surface.

The degrees of temper corresponding to

the various shades of yellow are suitable to metal-cutting tools; those corresponding to the reds and browns are suitable for tools for cutting wood. The purples are for edge tools and drilling purposes, and the blues for metal-cutting chisels or steel to have great elasticity, as in the case of carriage springs.

Two examples of the manner in which steel tools are used to cut iron are given in the accompanying engravings; the first is a tool for that king of all metal-cutting machines, the lathe. The hook end of the tool in Fig. 1 is hardened, and the faces B and D are ground flat on a grindstone, giving to the tool, cutting edges at F and G. In Fig. 2 the tool is shown in action; the work is revolved towards the tool, and the tool is slowly moved in the direction of the length or axis of the work, the result being that it removes a spiral ribbon of metal termed the cutting or chip, whose form is very accurately shown in the engraving.

Fig. 3 shows the method of cutting flat surfaces. The work is held in a vise fastened to one part of the machine, while the tool is held by another part. Then either the tool is pushed over the work or the work is pulled beneath the tool, and in either case the tool takes off a cutting very similar to that shown in Fig. 2.

In other kinds of tools the metal is severed by sheer pressure, as in the case of holes that are punched or plates of iron that are cut by powerful machines, whose action corresponds to a pair of common scissors, only that in the machines one jaw only moves, while in scissors both move. All the difference that the hardness of the metal to be cut makes is that it must be cut slower, and the tools must be harder and stronger.

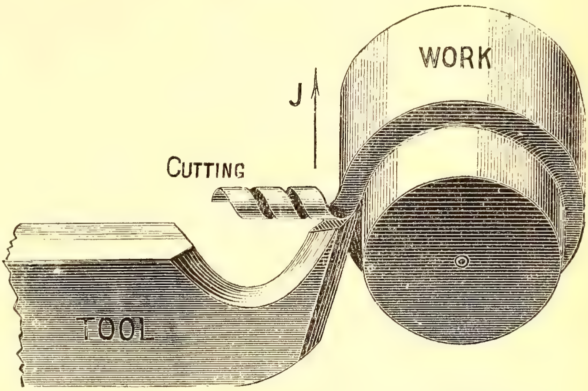


Fig. 2.

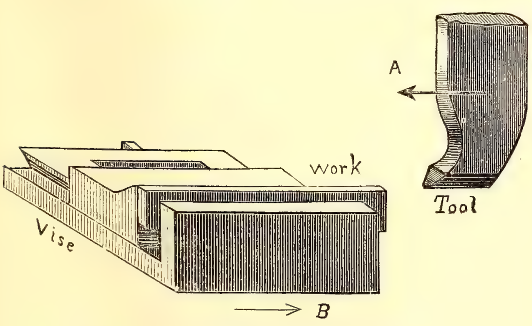


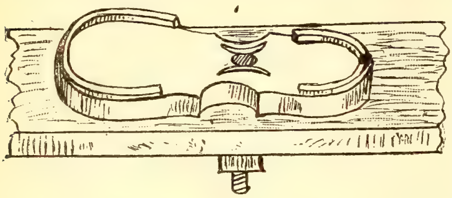
Fig. 3.

Practical Hints on the Construction of the Violin—IV.

WE promised in our last article, as the readers of the YOUNG SCIENTIST will remember, to describe the manner of working the inside of the violin-plates and of regulating their thickness.

We will suppose that the outsides of the plates have been carefully finished and well modeled. This being done, the workman turns his plate on the work-bench, as shown in the figure, and whittles out the wood with a gouge until the plate is of a uniform thickness—say a quarter of an inch. Let us now imagine that we are finishing the back. The backs of all good violins are found to be twice as thick in

the centre as at the outer edges, and it is in this that the operator's care and judgment are put to the highest test. Not only must the back be graded regularly



from the centre to the edges, and have its inner side as smooth and as perfectly finished as the outside, but it must be also capable of producing a certain number of vibrations in a given time.

In order that the operator may have a fixed scale to guide him in his work, let him take the length of the body of his instrument, lay it out on a piece of wood, and divide it into 72 equal parts. This will form a very convenient scale of measurement.

Let him then take his callipers, and adjust them so that they will take in just two parts of the scale. Let him then work down the centre of the back until it is exactly two parts thick. He may then commence to thin the plate towards the outer edges until the edges show one part in such a manner as that the plate will grow gradually thinner from the centre to the outside, like a wedge.

When this has been carefully done, he may test the plate for sound. In order to discover the proper pitch of the back of a violin a considerable amount of experiment will be necessary on the part of the amateur. When the back of a violin has been properly worked out it should give, on percussion, the note *Do* of 512 single vibrations in a second. It requires a good ear to perceive this, for the reason that a sound emitted by a piece of wood is not so clear or so well defined as that given out by a musical instrument. The best way to arrive at a good result is to procure a sliding *pitch-pipe* and set it at *Do* 512 vibrations, or *C* on the *G* string of a good violin properly tuned. Let the amateur then understand that there are *three nodal lines* in the back of the violin (or lines of no vibration). One of these lines runs down the centre of the back, and the two others cross this centre line at right angles, one through the middle of the larger end, and the other through the middle of the smaller end (when I say the middle I mean about the middle). Let the amateur take hold of the back where two of these nodal lines intersect with his forefinger and thumb, and strike the plate with his knuckle or with a piece of wood, and he will find that it will emit a very well defined sound, which he will find, on blowing into his pitch-pipe, to be sharper or flatter than the note given by the pitch-pipe. If the note emitted by his newly-made back be flatter than 512 vibrations in a second, he may throw the back away as worthless—the wood is of bad quality, and it will never make a good violin. If, on the contrary, the back gives a sharper note than his pitch-pipe, he is all right. All he has to do in that case is to carefully thin the back with fine sand-paper until it gives the required note. When all this has been carefully done, he may attach the back to the ribs. In doing this let him take thin hot glue, and with a brush run it around the edge of the plate and also around the ribs where they are to be joined to the plate—this must be done quickly, that the glue may not have time to set. He then lays the ribs which are still attached to the mold on the back, and, with small clamps, brings them tightly together. The clamps should not be removed before eight or ten hours.

The next operation is the finishing of the belly or upper plate of the violin. This will be found much more pleasant than the working of the back—first, because the wood is softer, and secondly, because it may be made of equal thickness throughout. Indeed, the bellies of the best violins are of this style—equal thickness throughout. But it must be borne in mind that the belly must be thinner than the thickest part of the back. The timber of the belly is more resonant than that of the back, and, for the same dimensions, gives a sharper tone. Consequently, if the both tables were of the same degree of thickness, the tone of the belly would be altogether too high for

the back, and the instrument would be worthless. It will not do to have both plates in unison, or giving the same sound. The belly must be a whole tone, or at least more than a semitone sharper than the back, to give good results. If the back gives *C* 512 vibrations, the belly should give *D*, the next whole tone above. The amateur should, therefore, carefully work out the belly of his instrument until he has arrived at the proper degree of thickness, and he must bear in mind that the better he does his work the more perfect will be his instrument.

All tools should be kept perfectly sharp, so that the wood may not be torn off but cleanly and smoothly cut. The inside of a violin should be as carefully finished as the outside.

There is something we forgot to speak of in its proper place, namely, the cutting of the grooves around the edges of the plates and the inserting of the *fillets* or *purfling*. We will return to this part of the work in our next article, and explain the manner of inserting the bass bar—a thing which is one of the great secrets of violin-making.

Amateur Wood-Carving.

SOME excellent lessons on wood-carving have appeared in previous numbers of the YOUNG SCIENTIST, to which we gladly refer those of our readers who have not attempted the art heretofore, but who intend to practice it now, with a view of becoming adepts. Wood-carving has always been to the uninitiated a *terra incognito*, but, like most of the arts practiced for industrial and decorative purposes, the unknown and mysterious gradually disappear on closer acquaintance, until the art becomes as familiar as any other of our occupations.

No amateur will be able to work with satisfaction, or turn out creditable results, unless he possesses the necessary tools and appliances for doing so. In the articles referred to some of the tools required by the carver were illustrated and described. In addition to the tools already spoken of, we may add the following, which will be found more or less useful for various purposes: A small hard brush, for brushing out dust and small chips from diaper or other depressed work. A marking-gauge of the ordinary type, a wood rasp, and a riffler, same as shown at Fig. 1, which is an excellent tool for

Fig. 1.

finishing up nooks and corners. A pair of medium-sized, egg-shaped callipers will often be found useful. We show a pair, which we think is the most suitable in shape for the carver, at Fig. 2. A pair of

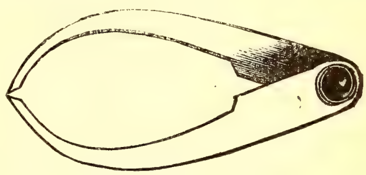


Fig. 2.

spring dividers will also be found useful; and these should be good and about the style shown at Fig. 3. Although most of the paring and cutting may be accom-

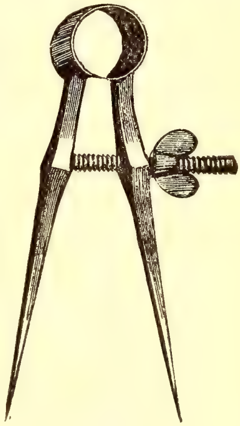


Fig. 3.

plished by pressure alone, or by a gentle tap on the handle of the cutting tool with the palm of the hand, there will be some cases where it will be necessary to make

use of a mallet; the one shown at Fig. 4 presents, perhaps, the handiest shape, as it is always in the right position when in the hand. It may be made of beech, hickory or iron-wood. It should be light and handy. Another useful contrivance that can be easily made by any handy amateur is a "router," sometimes called by workmen a "hag's tooth." It consists of a piece of hard wood, preferably beech, about two inches wide and one and a half or more inches thick, and from five to eight inches long, with a slot or mortice cut through the centre to admit a chisel or other cutting tool, which is held in the slot the same as a plane iron is kept in place. Fig. 5 shows the block, A, and the cutter, B.

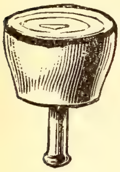


Fig. 4.

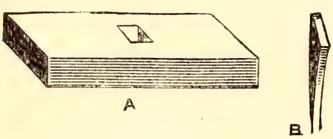


Fig. 5.

The tool is especially useful for regulating the depth of groundwork of panels, etc. It can be made of various sizes, but the most useful will be of the size named, and made to admit a cutter about a quarter of an inch wide. In using this tool the groundwork is first cut out, to some extent, by a quick bent tool; the cutter is set to the depth required, and by working the tool backwards and forwards, a perfectly flat surface is obtained. The stones required for sharpening carving tools should be the very best that can be obtained. Arkansas or Turkey stones are probably the best, but we have got good results from Washita stones; perhaps for slips and other small stones it is better to procure Arkansas ones, as they generally give the best satisfaction for sharpening inside work, such as the inside of gouges, veining tools, etc. In general, a quick cutting stone is the best for large tools, and a fine-grained, slow cutting one for the small and finer tools. With small veiners and parting tools a piece of pine is cut—across the grain—so as to fit inside of the tool to be sharpened, and emery powder and oil is then used to rub out the inside of the tool. Other tools and contrivances, such as small files of various sizes, scrapers of different shapes, and cutters of suitable forms, will occur as wants to the amateur, when he enlarges his field of labor.

After the inside of a tool has been thoroughly rubbed out, and there is not much danger of sharpening it too much from the inside, the outside edge should be finished off by sharpening on the main oil-stone, and when this is done, the tool should be laid flat on the stone and moved gently to and fro, until the required edge is obtained. Care should be taken to keep the edge of the tools perfectly square and even.

In sharpening the outside of tools with a slip the tool should be held in the left hand; then move the stone sharply up and down the edge with the right hand, except in cases of flat tools, when the stone may be placed on the bench, and both hands used to grasp the tool. The best of sperm-oil should be used as a lubricant on the stone. Other clean oils will answer tolerably well, but it is always better to use sperm or olive. Sometimes emery powder or flour emery is used on the stone, to increase the cutting power, but this is not a desirable practice. To put a finishing, clean-cutting edge on the tools, a piece of leather may be used. This may be glued on the top of the oil-stone box, or it may be fastened on an independent piece of wood. The leather should be plentifully saturated with hard mutton tallow and cro-

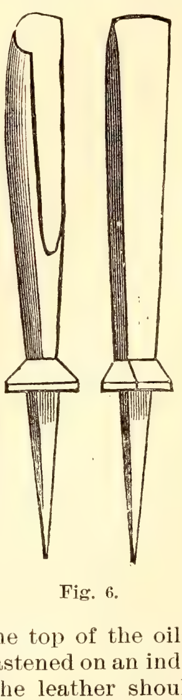


Fig. 6.

cus powder well rubbed in before a fire. When properly made, this strop will be found to give a keen edge to the tools, and by a little ingenuity in the make-up, may be made so as to answer in sharpening the inside, as well as the outside, of tools.

Fig. 6 shows two tools properly sharpened. It will be noticed that the basils or bevels of the tools are long and evenly made.

A good way of testing the keenness of edge on a tool is to try it on a piece of soft pine, cutting across the grain, when, if the tool is properly sharpened, a clean cut, without any tearing of the grain, will be the result.

In future issues of the YOUNG SCIENTIST examples for carving, with full instructions as to operation and materials, will be given.

Scroll-Saw Novelty.

NO doubt many of our readers who own scroll-saws will be glad to get a design for making a handsome, and at the same time efficient, summer fire-screen, like the one we illustrate and describe below. Fig. 1 shows the screen completed on a reduced

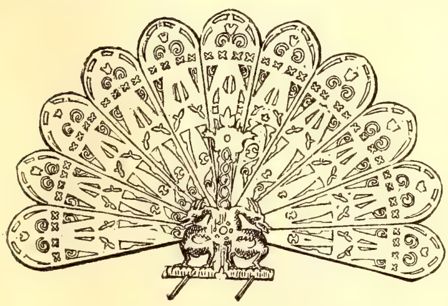


Fig. 1.

scale. The actual height of screen from floor will be about twenty and a half inches to top of central leaf. Eleven of the leaves (Fig. 2), two uprights (Fig. 3), and two cross-pieces (Fig. 4), complete the design. To work the leaves a fine close-grain but light wood should be chosen, not more than $\frac{1}{8}$ inch in thickness; to avoid monotony and trouble, at least four leaves may be worked at a time

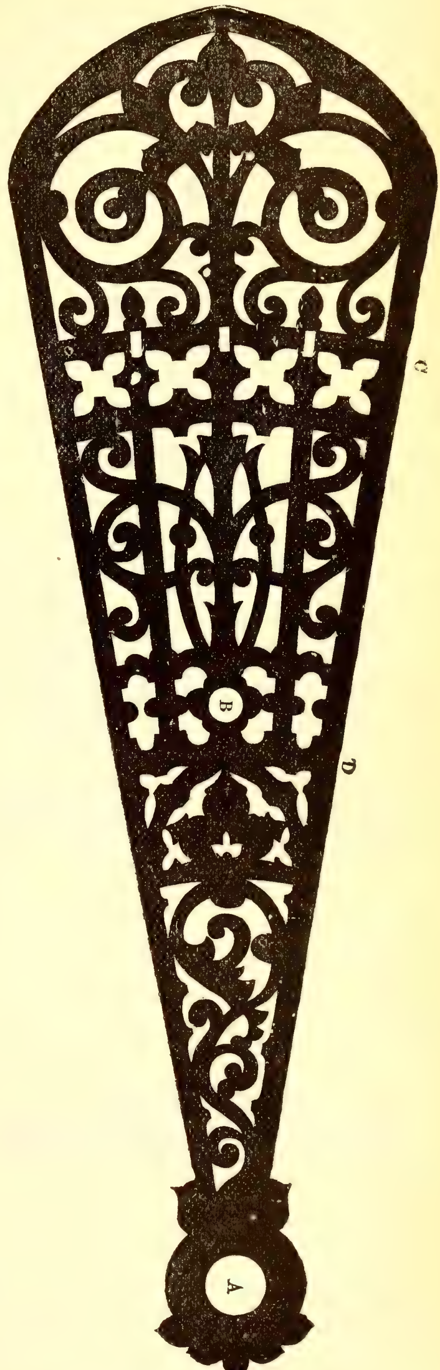


Fig. 2.

by bradding the wood together, seeing that the brads pierce only those parts of the design that are cut away, and working those portions the last. For the uprights (Fig. 3) a thicker piece of wood should be chosen, ¼ to ⅜ of an inch. One of these for the back would be best left

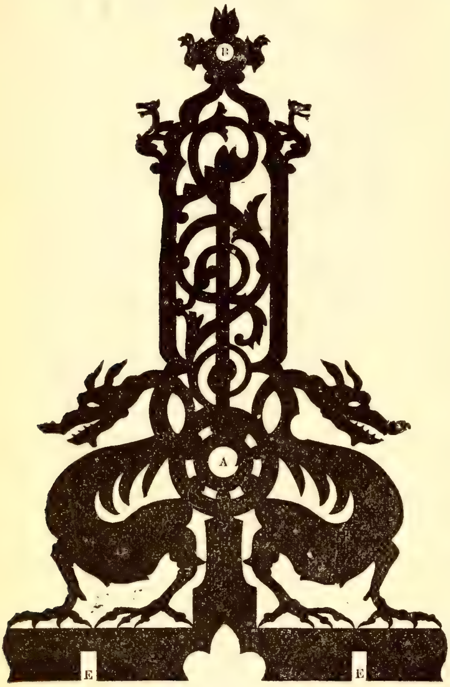


Fig. 3.

solid, the outline only cut; this gives more weight to the base. Two pieces (Fig. 4) should be worked in the thickness of the uprights. These pieces and the standards are notched into each other, as shown at E, E, in Figs. 3 and 4. Between

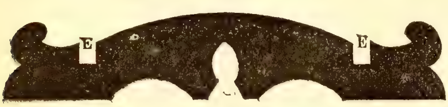


Fig. 4.

these, when put together, fit a square block of wood weighted, or else stand the whole on a wood block for the base, to which it should be fixed. To put the leaves together, thread them with ribbon like an ordinary lady's fan. This is so simple, and within everyone's reach, that it is not necessary to explain the construction; the ribbon is fixed in its place with glue. A peg fitting tightly connecting the uprights (at A, A, as in the design) is first passed through one upright, then through the holes A of the leaves, and fits into the back upright. If preferred it may be longer than the whole thickness it connects, and fixed with a peg through a hole at either end. A peg or brass nail hung at the back by a cord can be used to keep the fan shut up. By closing the leaves and passing the peg through the holes B, B, the fan will be kept closed when not required for use.

For alternative treatment the fan leaves might be cut in solid wood, and painted with any suitable design. In this case the uprights should be more simply made, probably the necessary uprights, in a simple form, based on this—⊥, would be best. The monotony of the work may be

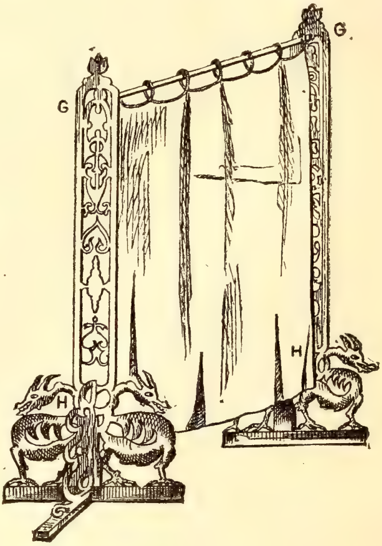


Fig. 5.

relieved by the leaves left solid between C and D (save the holes B), affording space for a spray of flowers to be painted.

If the uprights (Fig. 3) of the fan-screen are made much higher, and the lower part of the design is cut and placed at right angles, as shown in Fig. 5, the frame

connected by bars at G G, and H H, will be a substitute for a metal framework made for a similar purpose. A curtain in needlework hangs well on such a frame as this, and fulfils the purpose of screening what it is wished to hide as well, or better than many of the more elaborate designs.

The total length of leaf from point to point is 17½ inches; greatest width at top, 5½ inches; height of standard, 12¼ inches; width at bottom, 8 inches; width of shaft, 2½ inches. Cross feet, Fig. 4, are 7 inches long and one and a half inches wide. Walnut or mahogany would make excellent material for this screen.

Something About Saws.

BY "OUR NED."

IT is an old saying that "A bad workman quarrels with his tools." It might also be said with equal force that "Bad tools make a good workman cranky." Particularly is this so if the "bad" tool happens to be a saw.

An amateur's first experience with a new saw—cross-cut or rip—is generally of a pleasant nature, because then the saws are straight, sharp, and in good condition, and a saw in fine condition and sharp is one of the most pleasing tools to work with, and the most unsatisfactory if the reverse is the case. The reader will notice that I have made a distinction with a difference in using the terms "condition" and "sharp," and I will clear up this point before proceeding further. I use the term "good condition" to denote that the blade is in perfect order, devoid of "kinks" or "buckles," the line of teeth regular, and this line slightly curved, the teeth of equal size and "set," and at the proper angle with regard to the line of teeth. When all these things are complied with, in accordance with well-defined rules for the purpose, the saw will cut tolerably well, though it may not be very sharp. To be sharp a saw must possess keen points, and the edges of each tooth must be sharp and well-defined, and the angles of each tooth, with regard to the sides of the saw, must be regular and in accordance with rules I shall explain further on. A saw may be "sharp," yet perfectly useless as a cutting tool; therefore, let me impress on your minds the necessity of keeping this tool in the best of order. It is impossible to cut off a piece of board, plank or scantling straight and square with a saw whose teeth are formed something after the fashion of those shown in Fig. A.

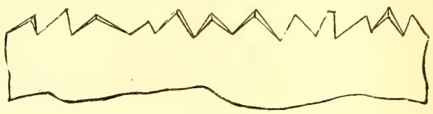


Fig. A.

This engraving, in a measure, represents the condition of many amateur cross-cut saws I have met with, and which, to my knowledge, have caused many an ingenious amateur to abandon amateur work altogether, so discouraging have been the results of their struggling labors with the tool. It might well be said of persons using such an instrument that they are on "a ragged edge."

Now, then, how can the amateur take care of his saws and keep them in good condition? I will endeavor to answer this question in a plain way, so that the reader will not get mystified or "mixed." In the first place, if you have not already purchased saws, see to it that, when you do buy, you get good ones, saws made by some good reliable firm who have earned a reputation for the excellence and efficiency of their manufactures. Remember that in this, as in all similar matters, you must pay a good price for a good article. Cheap saws, like cheap fruit, may look very well, but they contain the canker-worm of disappointment in their cores. When the saws are once taken home they should be rubbed over with an oily rag and either hung up or placed carefully away in a chest, if not in use. Never try to force a saw through a piece of stuff; if the material being sawed should warp or twist, as is often the case while being cut, and close up the saw-kerf so as to pinch the saw, any further attempt at sawing should cease, until the kerf is wedged open or the saw otherwise released. It is

during the forcing process that most of the "buckles" in saws take place. Sometimes saws may be "buckled" or "kinked" when not in use by having heavy weights piled on them, or by receiving a sudden blow, or by falling some considerable distance; all these adverse chances should be strictly guarded against. Another thing: before cutting any stuff, clean it well off, making sure that all sand, grit, and dust are removed. Avoid knots wherever you can, and be sure and examine the stuff where the saw has to travel, more particularly if the stuff to be worked is old or has been used before, as nails, tack or brad points may have been left in, and if the saw teeth should come in contact with them it would prove almost fatal to the tool. Never permit the tool to rust. If it should get wet, or accidentally get acid of any kind spilled on it, wipe it off clean and dry, and rub it over with an oily rag. Saws always cut better for being bright and clean. Care for a saw as you would for your razor and the results will be equally satisfactory.

The next thing to be considered is how to file the saw when it gets out of order. Of course, a saw right from the store, if in good condition when bought, ought to stand the slight wear and tear of amateur work for a year or more, if the foregoing

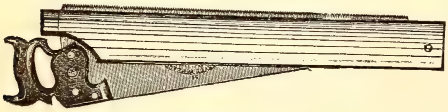


Fig. B.

directions are followed, but there will come a time when the tool must be filed. Let us suppose that time is at hand. The first thing necessary will be clamps or holders, between which the saw must be firmly held. Fig. B shows a side view of these clamps, with the saw in position, ready to be filed. It will be seen that the edge of the saw, or the "cutting edge," as it is called, stands above the bevelled edges of the clamps some little distance; this is to allow of the file being used with the handle hanging downward towards the operator, as shown at Fig. C.

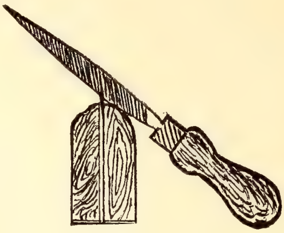


Fig. C.

These clamps may be made of pine, but had better be of hard wood. The end next the point of the saw may have a heavy wood screw in it, as shown in the drawing. The pieces forming the clamp should not be less than three inches wide and from seven-eighths to one and a quarter inches thick, and have the upper edges chamfered or rounded off, as shown in the section at Fig. C.

The clamps and saw should be placed in the jaws of the bench screw and firmly held in place. If the saw is a cross-cut, and has sufficient "set," and none of the teeth have been broken short by running against nails or other hard substances, the work will be very easy, as all you will have to do will be to set the file at such an angle as will fit it to the teeth as they now are. This done, draw the file to and fro very carefully, minding that the file does not press too heavily on any particular part of the tooth, and, above all, be mindful that the point of the tooth is not shortened, as this is one of the main things to be guarded against. Remember that in filing a cross-cut saw, the point of the file should always be towards the point of the saw, and this compels you to file every other tooth first, and when done on one side, the clamps and saw must be taken out of the grip of the bench screw and turned with the unfiled side toward the filer, who must treat this side of the saw just as he treated the first side. Now look along the edge of the saw, and, if your work has been done with anything like regularity, there will be a continuous angular groove along the edge of the saw, into which a needle may be laid

and slid from one end to the other of the saw. Now this is the simplest of ways to file a saw, but it is very seldom successful, from the fact that it is almost impossible to follow the lines of angles first made in the saw without making some teeth smaller than others, and again, it is *unscientific*, and therefore unsound. Consequently, it is much better to learn how to file a saw on correct principles.

Three kinds of teeth are used on hand-saws for cross-cutting; one for cutting very soft wood, such as pine, whitewood, basswood, butternut and chestnut. This kind of a tooth, enlarged, is shown at Fig. D.

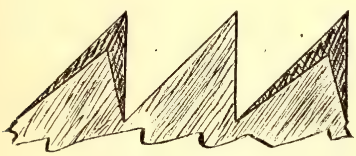


Fig. D.

I do not advise the use of this tooth for the amateur, for many reasons, among which may be mentioned the difficulty of keeping it in order, its liability to break and otherwise get dull, and its unfitness for use on hard woods.

Fig. E shows teeth that are adapted for

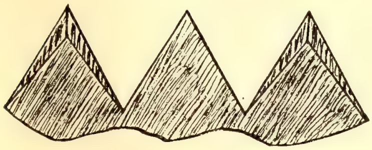


Fig. E.

either hard or soft wood, and are the teeth the amateur should always adopt, as they will work with tolerable ease in either case.

Fig. F shows three teeth adapted particularly for hard woods. It will be noticed that these teeth have wide bases and are more obtuse than the teeth shown in the two previous examples. These three examples of teeth show all that the amateur will care to know of saw teeth suitable for cutting across the fibres of wood, hard or soft. Of course, these shapes may be slightly varied to suit conditions, but the principles involved will always remain the same.

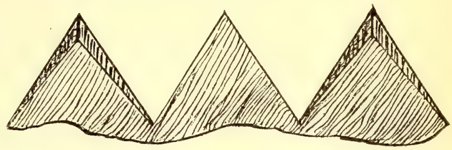


Fig. F.

Portions of saws, showing the teeth about the right size for working, are herewith illustrated, giving the reader an idea of what the saw should be.

Fig. G shows the teeth for soft wood, the same as shown at Fig. D. Fig. H shows the teeth suitable for either hard or soft woods.

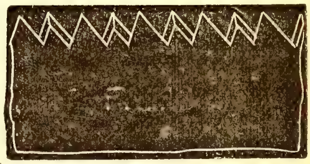


Fig. G.

This is the style of tooth I recommend for amateur use. It will not cut so rapidly as the teeth shown in Fig. G, but it will give better satisfaction all round.

Fig. H.

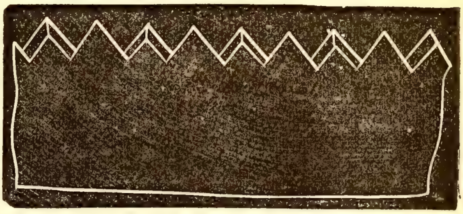


Fig. K.

Fig. K shows the teeth best adapted for cutting hard wood, and it shows the teeth about the size they should be for an ordinary hand-saw.

So far I have only dealt with hand-saws for cross-cutting; in subsequent issues of the Young Scientist I will have something to say on ripping-saws, which require a different mode of treatment than those I have mentioned. The several

other saws, too, which the amateur will have occasion to use, must not be overlooked in future numbers.

Sea Anemones.

BY A. W. ROBERTS.

MARINE anemones belong to the polyps or anthozoa, which consist of cylindrical animals with an opening (the mouth) in the centre of the upper end. This mouth is surrounded by six, eight, or many more hollow tentacles, which are used to seize the food. As soon as the food is passed to the mouth it is pressed down into a central longitudinal bag or inner tube (the stomach), where it is retained until all the nutriment has been extracted; the residue is then passed out through the same opening through which it was received. This having been completed, the nutritious matter passes through the lower open end of the stomach into the cavity of the body, and thence upward into the space between the walls of the stomach and the body.

This space is divided, by radiating partitions, into many longitudinal sections or tubes, which continue into the hollow of one or several tentacles. As will easily be understood, the nutritious matter can reach the extreme part of every tentacle. The polyps either live singly or in colonies, in which latter case they form the coral reefs; polyps or anemones which live singly are larger, but both display a wondrous beauty of form and color.

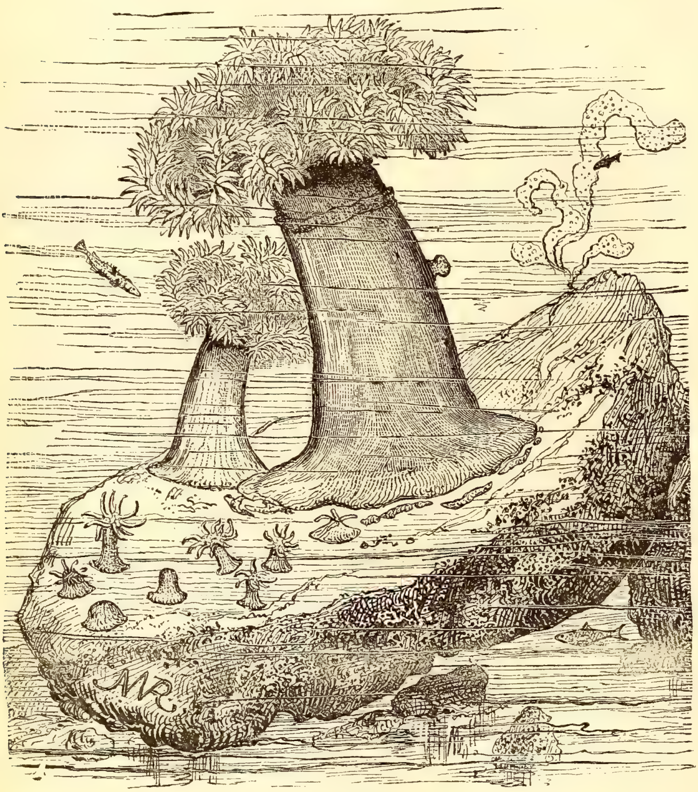


Fig. 1.

The fringed sea anemone *(Metridium marginatum)* is the most common among the anemones of the northern part of North America. It can be easily distinguished by the mass of soft, plumy tentacles that surround its disk. When contracted it looks like a mere lump of brownish or whitish jelly, but, when fully expanded, it displays such wondrous form, grace, and beauty as to hold the attention of the most careless beholder. "From the extended base," says Prof. Verrill, "the body rises in the form of a tall, smooth column, sometimes cylindrical, sometimes tapering slightly to the middle, and then enlarging toward the summit. Toward the top the column is surrounded by a circular, thickened fold, above which the character suddenly changes, the skin becoming thinner and more translucent, so that the internal radi-

ating partitions are visible through it. This part expands upward and outward to the margin, which is folded into numerous deep undulations or frills, which are everywhere covered with numerous fine, short, crowded tentacles." In color this variety of anemones varies from pure white, through all the grades of the browns, often pink, salmon color, and at times beautifully mottled. When the anemone slowly glides along the smooth surface of a rock, or up the glass walls of an aquarium, it often detaches (by contraction) small particles of i's body (from the base or foot part on which it moves). In the course of a few days these begin to develop tentacles, as shown in the illustration, Fig. 1. Other varieties propagate by budding from the side of the column, and by small egg-like bodies which are ejected from the mouth. The white-armed anemone (*Sagartia leucolena*) shown at the right hand in Fig. 2, is a small variety found in great abundance on the submerged timbers of all the public and private swimming baths that are stationed in summer time at the down town section of New York City, particularly Hall's swimming baths at the Battery. The small salmon colored anemone, seen at the left hand in the illustration, is likewise to be met with in immense quantities at Baxter's and other swimming baths situated on the East River from Fifty-first Street and higher up.

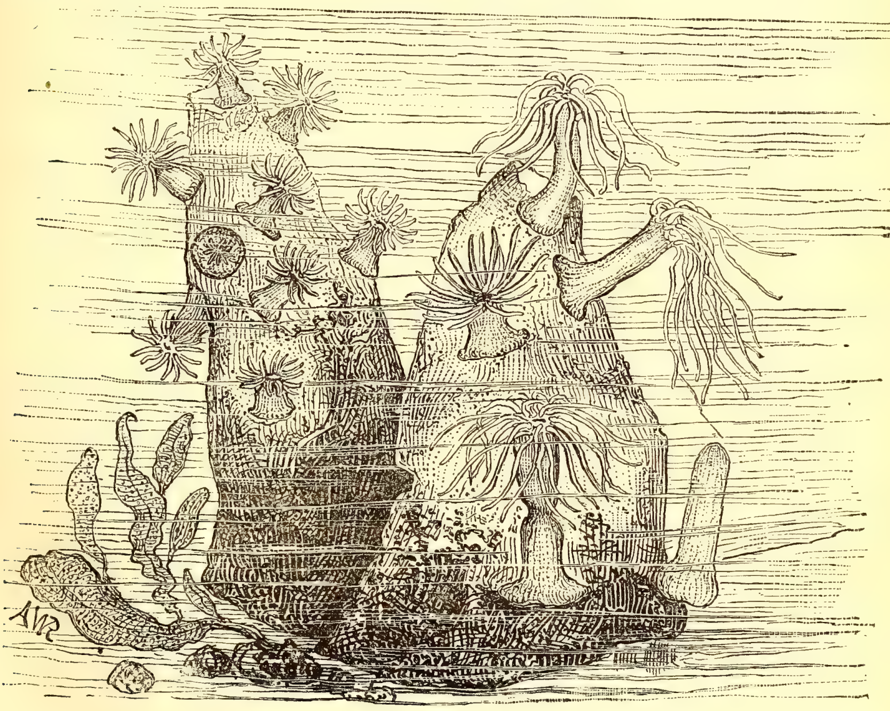


Fig. 2.

The stout-armed anemone (*Tœlia crassicornis*) which for short is called by keepers of aquaria the "Crass," is the largest and most brilliant of all the North American anemones. Its body and disk are brilliantly marked with red and white strips. It is a ravenous feeder and does not hesitate to take into its capacious maw a good sized mussel, or even a fish, if it but once obtains a good hold of it with its tentacles. All the specimens that I have had of this variety of ane-

mone, were obtained by the cod and halibut fishermen, but I was never successful in keeping them alive for more than a month at a time, and I have often thought that this was due to the absence of the great pressure of water, and the greatly subdued light which exists at the bottom of the ocean where they were caught.

In the English aquaria this same anemone has been kept as long as ten years. At one time I had seven varieties of English anemones in my tanks, and curious to relate they all outlived both the American and German varieties, some having lived from the opening of the aquarium till its closing, a period of four years.

I also had several collections of Bermuda anemones, but they too were delicate, with the exception of a medium sized variety of a magnificient light and dark maroon color. This variety was very hardy, and reproduced both by division and eggs, which it ejected from its mouth in large quantities. When collecting anemones at night time at Wood's Hole, on the Massachusetts Coast, the tender skin on the inner part of my fore-arm was constantly blistered. This arose from the fact that the anemones when being taken with a scraper throw off and surround themselves with quantities of a transparent and gelatinous fluid, which when applied to the tongue instantly blisters it. They are undoubtedly provided with this peculiar material by nature as a means of defence. They are also provided with numerous *lasso cells* in which very minute, long, and thread like " lassoes " are curled up, and when capturing a live fish they project them from all directions. With these invisible threads the fish is not only entangled, but is also stung and held fast with the aid of the tentacles. As an illustration of the wonderful reproductive properties of the anemones, and their great tenacity of life, I will, in the next number, relate several interesting experiments that I have made when curator of different public aquaria.

— There lives more faith in honest doubts, believe me, than in half the creeds.—*Tennyson.*

The Late Transit of Venus; Its Nature and Utility.

BY BERLIN H. WRIGHT.

AN event which attracted great attention from all classes, and will be forever remembered by astronomers as the greatest astronomical event of the nineteenth century, was the transit of the planet Venus across the sun's disc on the 6th of last December. The unscientific naturally ask the reason of the great commotion made by the passage of our sister planet between us and the ruler of our system, appearing simply as a small black spot moving slowly across the fiery face of the sun. Admitting that it is a very unusual occurrence; that but four such events have occurred of which the world has record, and that the next one will not occur until June, 2004, aside from these facts, why have so many hundred thousand dollars been expended in fitting out expeditions to distant parts to observe this transit? The answer is that through this phenomenon astronomers hope to solve a celestial problem which has baffled the skill of the most learned heads for 4,000 years—the actual distance from our earth to the sun, and from that as a base of calculation, the distance of all the other planets from the sun, and in fact that distance is used as a " base line " from which all the other elements of the solar system are computed. Before explaining how these results are brought about we will explain more fully the nature of the phenomena.

Venus revolves about the sun once in 225 days, and the earth in 365 days. These are called *siderial* revolutions, or revolutions as seen from the sun. But to an inhabitant of the earth Venus has not made a revolution around the sun, because at the end of 225 days she is not in the same apparent place, with respect to the sun, as at starting. Suppose the planets to be in conjunction at the points *b* and *a* in Fig. 1. When Venus has made a complete revolution the earth has only reached the point *c*. It takes Venus 2½ of her years to overtake the earth, or to come into the same position with regard

to the sun; this is called a synodic revolution. In 584 days after the planets start together from *a* and *b* they will again be in the same relative position with respect to the sun, and if, as represented,

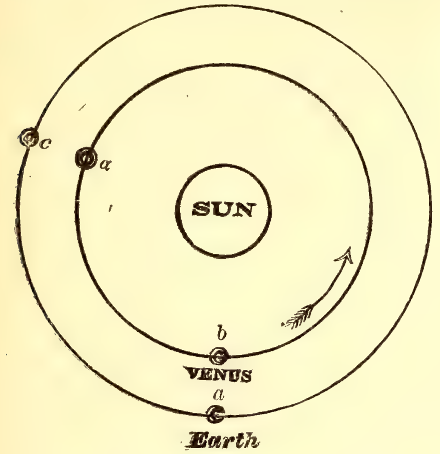


Fig. 1.

the orbits of these planets were in the same plane, a transit would occur every 584 days. But such is not the case; the orbit of Venus intersects the earth's path, as do the orbits of all the planets, and may be compared to barrel hoops shoved

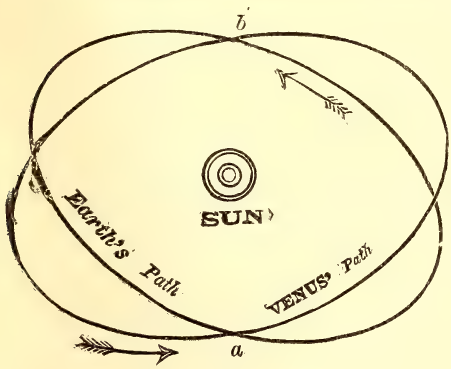


Fig. 2.

through each other, and the points of intersection, *a* and *b* in Fig. 2, are called the Nodes. The Node *a*, where the planet passes above the earth's path, is called the Ascending Node, and 180° from there, at *b*, where it passes beneath the ecliptic, the Descending Node. Now suppose Venus in inferior conjunction or between the earth and sun, as at *b* in Fig. 1, and the earth to be at that point, *a*, in its orbit where the orbit of Venus intersects it; then must Venus make a transit, and only at the points *a* and *b* can a transit occur. It is found that about thirteen of Venus' years equals eight of the earth's, and that about 235 of the earth's equals 382 of Venus'. Hence, having known the date of a former transit, the years when others may occur can readily be obtained. They cannot recur in less than eight years, and if not then 235 years must elapse before another can occur at the *same* Node, or 105 at the *other* Node.

"How do you hope to arrive at the exact distance from the earth to the sun from observations of a transit of Venus?" We will endeavor to give a simple explanation of a very difficult problem.

Two observers, situated at widely different points upon the earth, as at N and S in Fig. 3, will see Venus projected upon the sun's disc at different places; the one at N will see Venus at H, and the other at W, and the two lines, *a c* and *b d*, show the apparent paths of Venus as seen at the two stations. The length of the line W H is the "parallax" of Venus, or the amount of apparent displacement suffered by that planet from being seen from widely separated points. The length of this line can be readily computed. The rate of movement of Venus in transit is known with great precision, and when, from observation, the instant of ingress or egress of the centre of the planet is known, the time of her describing the chords *a c* and *b d* becomes known, and from that the *length* of those cords. Thus, if the rate of motion be 4′ 3.5″ per hour, and the time be 5h. 42m., or 5.7h., the chord *a c* must be 5.7 times 4′ 3.5″, or 23′ 7.95″ long; in a similar manner the length of the other chord, *b d*, becomes known. The angular radius (apparent semi-diameter) of the sun being known, say 14′ 55.8″, at that time, and taken = 1, then half of the chord *a c* or W *c* would be .7747. Now C *c* = 1, from which take the square of .7747 and extract the square-root of the remainder, and the result will be .63233, the length of C W. By proceeding in a similar manner with the radius C *d* and the half-

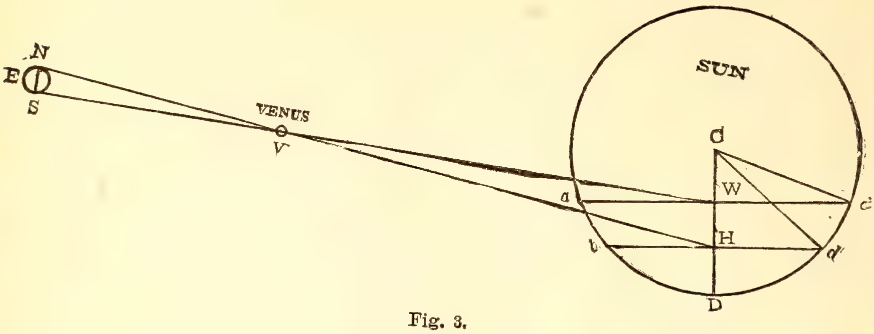


Fig. 3.

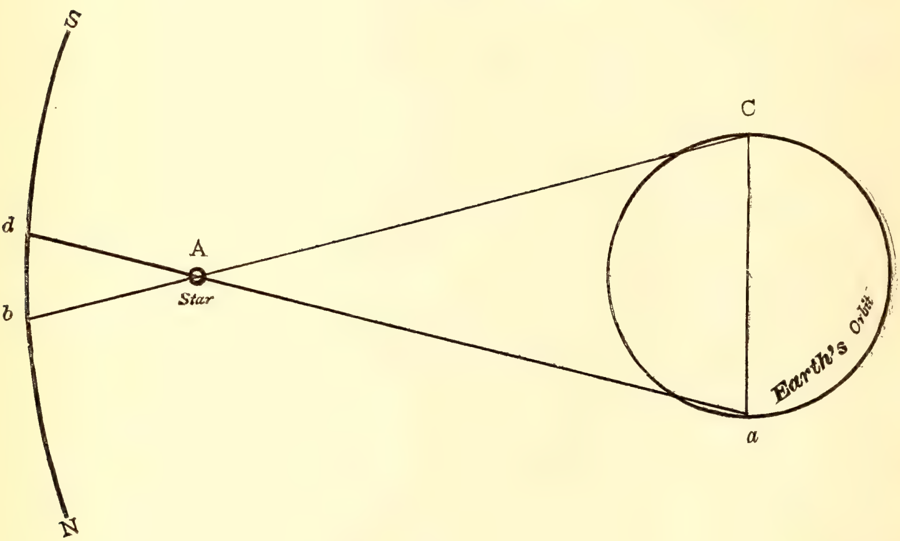


Fig. 4.

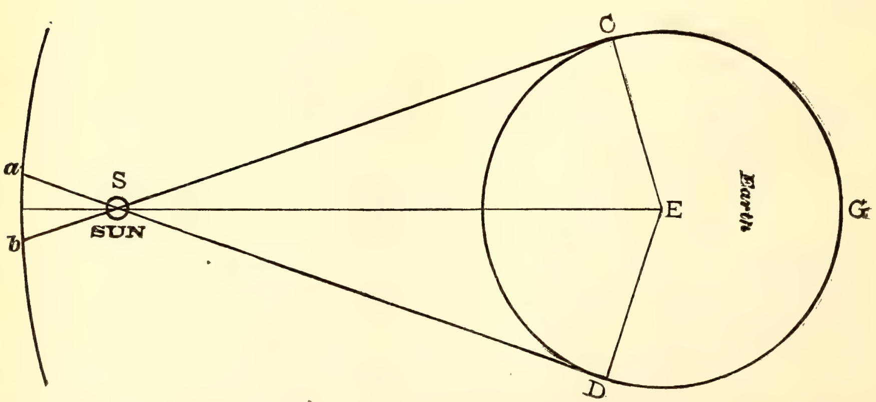


Fig. 5.

chord H *d*, the length of C H becomes known. From C H subtract C W, and we have W H, which is really the object sought, and is the parallax of Venus. "But this is not the parallax of the *sun.*" True, but the parallax of the sun is obtainable from it.

It is known that the distance of Venus from the sun is 72-100 of the earth's distance. Now let the earth's distance be represented by 100, then Venus' distance from the sun would be 72, and her distance from the earth 28. Now, as the ratio of the parallaxes varies inversely as the distances of the bodies, the parallax of the sun can be ascertained by the following proportion: E V : V W : : N S : (?) or, calling the earth's *radius* 1, we have 28 : 72 : : 2 : (5), or as 1 is to 2½. In place of N S the actual distance between the two observers will be substituted, which is their difference of latitude. In other words, this proportion shows us that the displacement (parallax) of Venus is 2½ times less when viewed from the points N and S in Fig. 3, than if viewed from the distance of Venus. But the sun's *horizontal* parallax, the amount of displacement suffered by the sun when seen from the *centre* and circumference of the earth, must be still half of this or one-fifth of the parallax of Venus. Suppose the arc W H = 42.8″, then must the sun's horizontal parallax be 8.56″. The correctness of this method depends upon the accuracy with which the angles are taken, but it will be seen that any error of observation is reduced five times in the final result. The extreme delicacy of the operations required may be judged from the fact that the difference between the old parallax (8.73″) and the latest (8.82″) or .09″, is equivalent to about 1,000,000 miles, and this arc (0.09″) is no greater than would be the apparent thickness of a human hair viewed at a distance of 100 feet. Notwithstanding the apparent insignificance of the figures, the latter estimate adds many millions of cubic miles to the calculated volume of the sun and many times the earth's mass to its weight; changes the estimated distances, volumes, masses, and diameters of all the other planets. A still greater error is made in computing the distances of the fixed stars. The earth's distance from the sun is used as a base line to compute the distance of the stars. Thus, in Fig. 4, which, of course, is not drawn to scale, the better to illustrate, when the earth is at *a* in its orbit a certain star (A) is observed to be at *d* in the heavens S N, and six months from the date of the first observation, when the earth is at C, the same star appears at *b*. Now it is a fact that the nearest fixed star shows *no* displacement when viewed from *c* and *a*, 184,000,000 miles apart. But nevertheless this method is used indirectly to ascertain the depths of stellar space, and the distances of over a dozen stars is known; and hence it is that this minute error in the sun's parallax of .09″ will produce an *error* of 200,000,000,000 miles in the calculated distance of the *nearest* fixed star, and in some whose distances have been computed this error would be increased *fivefold!*

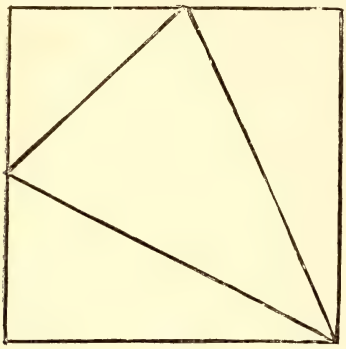
"But how do you find the sun's distance from the earth from the horizontal parallax?"

In Fig. 5 let C D G represent the earth and S the sun; then, according to what we have already shown, the sun's horizontal parallax is the angle E S D or E S C, or, in other words, the *earth's apparent semi-diameter*, E D or C E, as *seen from the sun.* Then, in the right-angled triangle E D S, we have given the angle E S D and the side E D, to determine the hypotheneuse, E S, or the sun's distance, one of the simplest problems of plane trigonometry. The earth's radius, divided by the sine of the sun's horizontal parallax = the distance sought. Thus we find, by using a parallax of 8.82″, that the sun's distance is 23409.4 times the earth's radius, or 92,759,700 miles distant.

—M. Tissandier, the French aeronaut, has devised an elliptical balloon, which is to be driven by a dynamo machine and storage batteries. The balloon will be 131 feet long, and will have a capacity of more than 100,000 cubic feet, with a lifting power of 3½ tons, which will allow for a ton of passengers and ballast. It does not require much knowledge to see that such a machine must prove a failure.

Solution of the Mathematical Puzzle.

LAST month we gave a mathematical puzzle, of which we now give the solution. No explanation is necessary as the engraving tells the whole story. Place the pieces



MATHEMATICAL PUZZLE.

shown on page 13 of our last issue in the relative positions which they have in the figure now given and the thing is done.

Our Girl's Department.

This department is intended exclusively for "Our Girls," and we hope to make it both interesting and instructive, and to this end we ask our young lady readers to assist by contributions, suggestions, or illustrations. There are thousands of little things that can be, and have been, made and done by young ladies, pertaining to decorative art, needle-work, etc., etc., that would be gladly followed but for a want of knowledge on the subject, and we know of no more pleasing task for a lady than that of teaching her younger sisters that which they are anxious to learn, and which may prove of real benefit to them in the future, as well as being useful and interesting for the present. We trust we will have no difficulty in persuading those who have something nice to show or speak of, to make use of this department. Remember, it is open to all, and if you have anything worth knowing suitable for this column, send it along, and we will give it our best attention. Do not be afraid to write because you may fancy your composition is not perfect, or have other scruples of a similar kind. Do the best you can, and leave the rest to the editor of this department, and we are sure you will be pleased with your work.

GOOD manners is the art of making those people easy with whom we converse. Whoever makes the fewest persons uneasy is the best bred in the company.

— The greatest friend of Truth is Time; her greatest enemy is Prejudice; and her constant companion is Humility.

— The most delicate and the most sensible of all pleasures consists in promoting the pleasures of others.—*La Bruyere.*

— If you have two topics to talk to a friend about, one of which interests her the most, while the other interests you the most, begin with that which interests her the most. It will put her in good humor; it will confer pleasure.—*Bentham.*

— The true art of being agreeable is to appear well pleased with all the company, and rather to seem well entertained with them than to bring entertainment to them. A woman thus disposed, perhaps, may not have much learning or any wit, but if she has common sense and something friendly in her behavior, it conciliates people's minds more than the brightest parts without this disposition. It is true, indeed, that we should not dissemble and flatter in company, but one may be very agreeable, strictly consistent with truth and sincerity, by a prudent silence where she cannot concur, and a pleasing assent where she can. Now and then you meet with one so exactly formed to please that she will gain upon every one that hears or beholds her. This disposition is not merely the gift of nature, but frequently the effect of much knowledge of the world and a command over the passions.—*Addison.*

— Sea fern makes a particularly effective design for any purpose where a continuous stripe is necessary. It is easy to work, and, if carried out in the pale green tints of the natural weed, will harmonize with anything.

— Wall pockets are made of cardboard covered with embossed velvet, each flower in the pattern of the material being outlined in pearl or incandescent beads. Cord of the same color as the velvet is used to finish them off.

— A very good idea for the brightening up of a nursery or play-room consists in decorating the panels of the doors by the insertion of brightly colored lithographs, fitting them into the panels and framing them, if necessary, with a narrow beading of gilding. Most of our young lady readers possess taste enough to successfully perform this kind of work. When

neatly done, the result will be pleasing and satisfactory.

— An inexpensive winter plaque is oval-shaped and painted on wood. It represents two brown owls perched on the broken branch of a tree in a snow-storm, while one of them is gallantly holding an umbrella to shield his companion from the falling flakes. There is no brilliant coloring in this to cover up defects, and, to look well, the design must be executed with skill; then it is both pretty and odd.

— A speck of embroidered work, worth $60, to be applied to a chair seat, is but a drop in the ocean of decorative splendor.

— A scrap-basket formed of a small Japanese umbrella is a novel and pretty article shown at the New York Exchange for Women's Work. This is mounted on a six-inch stand of cherrywood, with point downward and the frame half expanded, and kept in this position by being wound around each rib by a silken cord passed from one to another near the top. Silk balls of different colors hang from all the points where the sticks are wound, and the handle is ornamented by a bow of pink and blue ribbon combined.

— Katie B—— sends us her thanks for presenting her communication of last month in such a readable form. She says: "Many handsome things, suitable for the house may be made from some of the cheapest of materials. I have made several covers for bureaus and toilet stands, of crash. Designs of leaves, flowers, twigs or fruit may be used and worked in generally with linen floss. Covers or tidies made of these materials have much to recommend them, as they can be washed whenever required, and do not lose any of their beauty by the operation. The work is generally made solid, and finished off by an insertion of drawn work and fringe. For furnishing bureau sets it has become quite fashionable of late to use etched linen, the favorite design being a thistle and bud, the full blown flower rising above the latter. Usually they are finished of with bows and ends of light colored satin ribbon."

— At a "Studio Tea" given in the large class-room of the "Ladies Art Association Studio Building," in Fourteenth street, New York City, tea was served by a company of young girls in picturesque costumes. The decorations of the large class-room and the studios, all of which were thrown open, were of a symbolic character; easels decorated with the leaves of the red oak, stood for artistic strength; busts garlanded with rosemary for thought; paintings framed in laurel and ivy, and a ladder of evergreens, painted palettes and pictures displayed on carved easels, were among the attractions of the occasion. The window draperies hanging by brass rings from maul-stick rods with a small palette for ornamental end; dadoes of burlaps tacked to a narrow moulding, and headed by a narrow band of garnet cloth, and the walls of a studio painted with trunks of forest trees spreading branches over windows and doors, and wall hangings for picture backgrounds, offered valuable hints for house decorations. The tables, about twenty in number, were laid in old style, old-fashioned homespun linen, prettily associated with color; ancient silver urns on Dutch tiles and brass tea kettles sending forth wreaths of fragrant steam; quaint American porcelain from the only hard porcelain pottery in the United States, and the qaintest of old-fashioned chintz covered chairs, with the bevy of rustic artist attendants, completed a pretty picture.

INGENIOUS HOME-MADE PICTURE CARDS.

A great deal of ingenuity has been recently developed owing to the steady and increasing demand for novelties in picture cards. This being the case many very amusing and also truly artistic combinations of natural materials have appeared in the hands of the large dealers of cards in New York City. I have selected one of the most unique, comical, and at the same time most easily made, as the materials are always obtainable. The two owls consist of *single kerneled* peanuts that have just a suggestion of a stem attached to them. This stem is intended to form the beak of the owls, yet it is not

absolutely necessary that the peanut should have the stem, as very good peanut owls can be made without it. Each peanut is cut away one-third with a very sharp knife or razor, and the kernel is taken out. The eyes can be cut out of stiff white paper with a punch. All harness makers use a punch just about the size required. Or they can be drawn in with a pen and the whites painted with a brush. The card used for mounting is a stiff white, gilt edged, plain card, 4½ inches by 3 inches. Much taste can be displayed when selecting the branch work that is to represent the tree on which the owls are to be placed. Always select small, not large clumsy branches. A branch of the liquid amber gum tree (called also the "alligator wood," "cork tree," etc.), with its characteristic structure will look much better than the smooth barked birches. For the foliage, any of our native mosses and lichens can be used, and also the imported French and German mosses. When attaching the tree to the card, don't attempt to glue it, but sew it on, or wire it on with fine thread or wire, and fasten at the back of the card. After the tree is secured in position on the card the moss foliage is then glued or gummed on (thick and transparent gum arabic is better than glue as it does not show where an excess has been used). After the gum has thoroughly dried the owls are glued in position. As to the title, motto, or sentiment, each one can suit herself. As novelties in this line appear in the New York market they will be illustrated in the YOUNG SCIENTIST, and directions given for making them.

THE

Young Scientist.

A Practical Journal for Amateurs.

(With which is incorporated "THE TECHNOLOGIST," "THE INDUSTRIAL MONTHLY," and "HOME ARTS.")

PUBLISHED MONTHLY AT $1.00 *PER YEAR.*

EDITORS.

JOHN PHIN. FRED. T. HODGSON.

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Will those of our subscribers who receive two copies of the YOUNG SCIENTIST, kindly hand the duplicate to some friend interested in such matters, and thus perhaps aid us in securing a new subscriber? Remember that every additional name enables us to improve the Journal, so that all have an interest in adding to the number of our subscribers.

Of course, it is always in order to subscribe for the YOUNG SCIENTIST, but when possible we would prefer that subscriptions commence with the first number of one or other of the volumes. This course will be more satisfactory to the reader, and will also make things pleasanter for the publisher, as it will lessen the labors of bookkeeping and smooth matters all round. And as a further inducement to this, we would say that we always try to make *continued* articles end with the volume, though sometimes, of course, it is impossible to do this.

The expeditions organized by the British for the purpose of observing the transit of Venus have been generally successful at all stations, with the exception of Brisbane. The Madagascar party have been very fortunate in their observations. The interval between the contacts at ingress, as observed at Madagascar and Bermuda, is about thirteen minutes. The ingress observations at the West Indies, combined with those of the Cape of Good Hope, will supply the means of making one good determination of the sun's distance; while the egress observations of the West, combined with those made in New Zealand, will furnish another.

Nothing will give us greater pleasure than to have our young readers write us freely on any matter connected with amateur science or mechanics, with a view to obtaining information on the subjects they may be working at. We cannot promise that in every case we shall be able to give the answer desired, but we can safely promise that in a large majority of cases we shall be able to materially aid the inquirers in their labors, and thus lead them on to the accomplishment of their objects. Much good may be done by asking for information through these columns, as many readers other than the inquirers may want to get the same information, but are, from many causes, deterred from writing. A postal-card, in most cases, will be quite ample for the purpose, but where it is not, letter postage does not prove very expensive, and is equally acceptable to us.

Those who, prior to the issue of this number, have sent fifty cents in the hope of receiving the YOUNG SCIENTIST for the whole of 1883, will not be disappointed. We shall send it to them even at a loss. But we have no hesitation in asking them to show the Journal to some friend, and thus secure another subscriber for us at $1.00. After the issue of the February number those who send fifty cents will receive the YOUNG SCIENTIST for six months only. We make them this liberal offer, however: Where we are satisfied that the fifty cents was sent in good faith, under the idea that the subscription to the Journal was that amount, we will send the YOUNG SCIENTIST for the whole year, if the sender will secure another sub-

scriber at one dollar. With such a journal as we are now giving, it ought to be no trouble at all to induce some friend to subscribe.

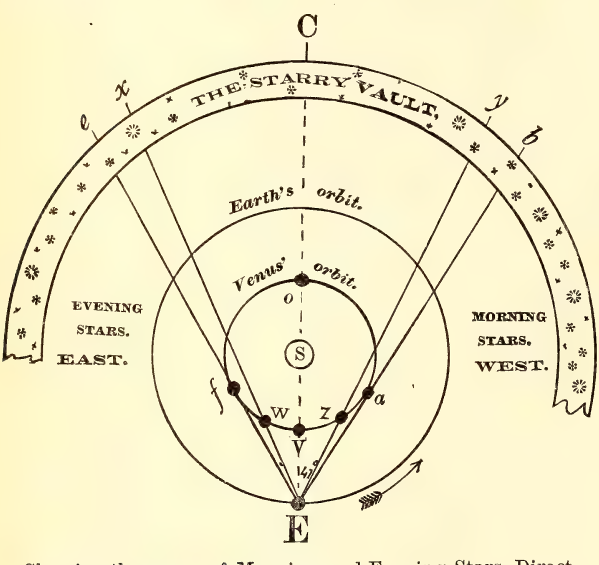
It is often amusing to read some of the articles said to be "scientific," that appear from time to time in our trade and other papers. Indeed, it seems to be the fashion now-a-days for every newspaper man to devote so much space daily, weekly or monthly, as the case may be, to scientific articles and instruction; and it frequently happens that the writer knows as much about the matter he writes of as he does about the anatomy of the man in the moon. Directions are frequently given for the performance of experiments and operations, which, if attempted to be followed, would surely end in disappointment, and often with injury to the operator; more particularly is this the case when chemical or electrical experiments are described; and we advise our readers to make sure of the correctness of the description and the innocence of the results before undertaking to follow the instructions. Of course, this only refers to those papers that make no pretentions to being scientific, but which seem to think it a duty to "dabble" occasionally in science. Most of these papers are good enough in their place, and are no doubt performing a useful mission, but it would be better for them and their readers if they followed the old proverb, "Let the cobbler stick to his last," and we are sure science would not be the loser under the condition.

The Planets.

FEBRUARY, 1883.

(All Computations are for the Latitude and Meridian of New York City.)

Venus.—The "Queen of Beauty," will continue to maintain her supremacy as the most brilliant star in the east in the morning throughout this month. She is now approaching a point in her orbit where her daily motion in right ascension is very much less than last month, and near the middle of next month she will be "stationary," as astronomers say; that is, she will *appear* to move neither east nor west. This, and the different kinds of apparent motion, can best be illustrated by the annexed diagram.



Showing the cause of Morning and Evening Stars, Direct and Retrograde Motion. The earth is supposed at rest at E during a revolution of Venus.

Suppose the earth at rest at E, and Venus at V. Then Venus will be nearest the earth, or between the earth and sun, and when first seen she will be just to the right or west of the Sun. When at *z* she will appear to be at *y*, and later, when at *a*, at *b*. This last space, from *y* to *b*, occupies just as much time as from C to *y*, the spaces V *z* and *z a* being equal. Her path from *z* to *a* being nearly in a line from the earth, causes her slight apparent motion. When at *a*, Venus is said to be at greatest elongation west. That is, the angle S E *a* can never be larger than when Venus is at *a*, making an angle at E of 47°. As she is then west of the Sun, she must of course rise before the Sun, and is therefore a morning star. She will appear largest, or have the greatest apparent diameter, when at *v*, but will not then be brightest as her unilluminated side is toward us. As she passes westward, a small edge of her illuminated side becomes visible as a silver thread of light or slender crescent; this increases as she approaches *a*, where one-

half of her illuminated hemisphere is seen by us as a half-moon phase; she is brightest, however, about 33 days before she reaches a. When Venus passes the point o of superior conjunction, where she appears as a miniature full moon, she will be seen east of the Sun, and must, therefore, set after the Sun, and is an evening star. From o to f her apparent motion is direct; at f she again becomes stationary, and from there to v her apparent motion is retrograde or backwards in the heavens. The amount of retrogradation is greatly exaggerated by supposing the earth at rest.

Venus rises on the 15th at 4h. 13m. morning, appearing as a small half-moon when seen in the telescope. New evidence of an atmosphere upon this planet was discovered at the recent transit.

Mars rises at 6h. 19m. morn., Feb. 15th.

Jupiter maintains about the same place as given last month, being stationary on the 15th. The Moon will be 2½° south of him on the 16th, and he passes the meridian on the 10th at 8 o'clock in the evening; 25th, at 7 P.M. Eclipses of his satellites may be seen in the evenings as follows (R. being for reappearance, and D. for disappearance. See note last month): Feb. 2, 6.56 R.; 3d, 7.39 R.; 9th, 9.31 R.; 10th, 9.34 R; 16th, 6.58 R.; 23d, 8.18 D.; 26th, 7.55 R. The transits transpiring in the early evening are: 2d, 7.12 Ingress, 9.29 Egress; 5th, 8.43 Eg.; 9th, 9.1 In.; 18th, 7.35 Eg.; 25th, 6.47 Eg. Occultations: 16th, 7.2 Dis.; 17th, 8.4 Dis.

Saturn is at eastern quadrature, or 90° east of the Sun on the 8th, and 1½ degrees south of the Moon on the 13th. He passes the meridian on the 10th at 5.49 P.M., and 25th at 4.53 P.M. The most distant and largest of his satellites, Japetus, is quite easily seen in small telescopes. This satellite will be at greatest eastern elongation Feb. 16th. The next in size, Titan, can be easily seen at the present time, being at western elongation on the 9th and 25th, and at eastern elongation on the 1st and 17th.

Uranus will be brightest March 12th, and may be readily seen with opera-glasses during February. He rises as follows: 10th, 8.1 eve.; 25th, 6.55 eve.; being about 2° S. of the 3d Mag. Star Beta Leonis, midway between Regulus and Spica.

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS, FEB. 20, 1883.

	H.	M.
Alpha Andromeda (Alpheratz) sets	9	51 P.M.
Omicron Ceti (Mira) variable "	9	59 "
Beta Persei (Algol) variable "	2	10 A.M.
Eta Tauri (Alcyone or Light of Pleiades) in meridian	5	39 P.M.
Alpha Tauri (Aldebaran) in merid.	6	27 P.M.
Alpha Aurigæ (Capella) "	7	6 "
Beta Orionis (Rigel) "	7	7 "
Alpha Orionis (Betelguese) "	7	47 "
Alpha Canis Majoris (Sirius or Dog Star) in merid.	8	38 "
Alpha Canis Minoris (Procyon) in meridian	9	31 "
Alpha Leonis (Regulus) in merid.	11	59 "
Alpha Virginis (Spica) rises	9	53 "
Alpha Bootis (Arcturus) "	8	56 "
Alpha Scorpionis (Antares) rises	2	3 A.M.
Alpha Lyrae (Vega) "	11	36 P.M.
Alpha Aquillae (Altair) "	3	16 A.M.
Alpha Cygni (Deneb) "	0	43 "
Alpha Pisces Australis (Fomalhaut) invisible.		

Penn Yan, Yates Co., N. Y.

The Tower of Nanking.

The celebrated porcelain tower, near Nanking, China, must have been very beautiful in its perfection, if we accept the statements of its various historians, who differ so little in their accounts that one does for all. From them we learn its form was octagonal, nine stories high, tapering as it rose to the height of 261 feet from the ground, the circumference of the lower story being 120 feet. The body of the pagoda was of brick, but its face was composed of porcelain tiles of many colors. Each story formed a kind of saloon, through which ran the spiral stair-case leading to the summit, and whose walls were covered with small gilded idols resting in niches, the entire apartment richly painted and gilded. Each story was defined by a projecting cornice of green tiles, from whose points gilded bells were hung. The roof was overlaid with copper, and above it rose a mast thirty feet high, capped by a golden ball and coiled about by an immense band of iron, appearing like rings from below. The base of this shaft was an iron ball formed of two halves, the outer surface of which is still magnificiently embossed, for one half rests where it fell, the only tangible thing in the mass of ruin. The other half, weighing twelve tons, being broken by the fall, was recast into a temple bell. Who were they that fashioned this beautiful casting, worthy the hand of a master? Whose writing and inscription embellished its face, unlike any Chinese workmanship? Whose skill was great enough in A.D. 1330 to place a ball of iron thirty-six feet in circumference, weighing twenty-four tons, upon a pedestal 261 feet high? This ball was the receptacle for various treasures calculated to ward off evil in-

fluences, among which were "night-shining jewels," pearls, books, gold, silver, thousands of strings of cash, satin, silk, and priceless medicines. The number of bells on the structure was 152, and the interior was illuminated by hundreds of lamps, while the exterior required 128 to light it. It took nineteen years to build it, and cost nearly a million of money. Of all this not one story rests upon the other. Lightning, fire, and war have laid their hands upon it, and it fell, its final destroyers being the Taeping rebels, some twenty-three years ago. It stood in the grounds of a Buddhist monastery which fell at the same time a prey to the fanaticism and rapacity of the invaders. One work of art within the grounds escaped destruction–a pure white marble tortoise, bearing upon its back a perpendicular tablet with an inscription. This with one solitary priest keeps watch and ward over the ruins of bygone glory.

Skilled Workmen of Other Days.

In the twentieth year of Queen Elizabeth, a blacksmith named Mark Scaliot made a lock, consisting of eleven pieces of iron, steel and brass, all of which, together with a key to it, weighed but one grain of gold. He also made a chain of gold, consisting of forty-three links, and, having fastened this to the before-mentioned lock and key, he put the chain about the neck of a flea, which drew them all with ease. All these together, lock and key, chain and flea, weighed only one grain and a half. Oswaldus Norhingerus, who was more famous even than Scaliot for his minute contrivances, is said to have made sixteen hundred dishes of turned ivory, all perfect and complete in every part, yet so small, thin and slender, that all of them were included at once in a cup turned out of a peppercorn of the common size. They were almost invisible to the eye. An artist named Claudius Gallus made for Hippolytus d'Este, Cardinal of Ferrara, representations of sundry birds sitting on the tops of trees, which, by hydraulic art and secret conveyance of water through the trunks and branches of the trees, were made to sing and clap their wings; but at the sudden appearance of an owl out of a bush of the same artifice, they immediately became all mute and silent.

The Mechanical Boy.

The mechanical boy should have a shop of his own. Let it be the attic, or an unused room, or a place in the barn or the woodshed. Give him a place and tools. Let him have a good pocket-knife, a gimlet, chisels, gouges, planes, cutting nippers, a foot-rule, saws, and materials to work. Let the boy have a chance. If he is a mechanic it will come out, and he will do himself credit. If he fails, he is to follow some calling that does not demand mechanical skill. With a foot-rule in his pocket, the boy will be continually measuring. Before he is aware of it, his eye will be educated to judge of dimensions and proportions. It is a good substratum on which to erect the knowledge of practical mechanics. Acquired as an amusement, this knowledge will become practically useful as the boy develops into the man. The employments suggested by the pocket-knife and rule will occupy many an otherwise idle hour, and afford a pleasant relief to the routine of school study and the weariness of oft-played games. The boy will become acquainted practically with substances, and be interested in the mechanical operations he witnesses, and this will pave the way for his easy entrance on the vast field of useful endeavor before him. He will become an intelligent and willing apprentice, and a judicious and skillful workman. Give the boy a chance.

The Oldest Newspaper.

The oldest newspaper in the world is the *King-Pau*, or "Capital Sheet," published in Pekin. It first appeared A.D. 911, but was irregular in its issues until 1351. Since then it has been published weekly until the fourth day of June last, when by order of the reigning Emperor it was converted into a daily, with three editions, morning, midday, and evening. The first edition appears early and is printed on yellow paper. This issue is called *Hsing-Pau* ("Business Sheet"), and contains trade prices, exchange quotations, and all manner of commercial intelligence. Its circulation is a little over 8,000. The second edition, which comes out during the forenoon, also printed on yellow paper, is devoted to official announcements, fashionable intelligence, and general news. Besides its ancient title of *King Pau* it owns another designation, that of *Shuen-Pau*, or "Official Sheet." The third edition appears late in the afternoon, is printed on red paper, and bears the name of *Tilani-Pau*, "Country Sheet." It consists of extracts from the earlier editions, and is largely subscribed for in the Provinces. All three issues of the *King Pau* are edited by six members of the Han-Lin Academy of Science, appointed and salaried by the Chinese State. The total number of copies printed daily varies between 13,000 and 14,000.

A New Puzzle for Young Folks.

Since the ingenuity and mathematical skill of the whole country were so severely taxed by the fifteen puzzle, with its curious and perplexing combinations, there has been a flood of similar contrivances, which have excited more or less interest, but all have fallen far short of the success attained by the pioneer in that line of amusement. The latest invention is the Nine-Letter Puzzle, and it bids fair to rival in difficulties the best of those that have gone before. The inventor, Mr. Sidney A. Phillips, as long ago as the winter of 1880, had perfected the combination of letters essential to the completeness of his puzzle, but he was only recently prevailed upon by his friends to have it copyrighted. The following diagram will convey an accurate idea of the arrangement of this puzzle:

P	L	O
C	I	A
D	Y	R

Each one of the nine letters above is printed on a small square block of wood, and to solve the puzzle it is necessary so to arrange these letters that they will form one complete square, having three letters on each side, and while constituting such a square the nine letters must also form eight different and distinct English words that can be found in a standard dictionary. These words cannot, of course, contain more than three nor less than two letters, and they must not read from the right to the left. The combinations must be made from top to bottom, vertically; from left to right horizontally, and from left to right diagonally.

For example, using the letters as they are printed in the diagram above, without any intention of spelling actual words, the following would be legitimate combinations: PLO, CIA, DYR, PCD, LIY, OAR, PIR, DIO, LA, CL, CY, YA, making in all only twelve possible combinations under the rules governing the solution of the puzzle. RIP, OLP, AY and others made from the right would not be allowable.

It can readily be seen that the solution of this puzzle under these conditions must be attended by no inconsiderable difficulties, and as the difficulties it presents can safely be taken as a measure of the success a puzzle will have, it does not seem rash to predict that the nine-letter puzzle will arouse no little interest.

In conversing about the obstacles he has had to overcome before reaching this final combination of letters, the inventor said that he devoted four months to the perfection of his plan. At first he tried but six letters, and then eight, and even when he had settled upon nine as the proper number, it seemed to him that five was as large a number of words as could be formed out of them. At last he struck upon the nine letters that constitute his puzzle, and is convinced by his numerous experiments and the efforts made by friends to solve it, that it is the most complete set possible.

One solution that has several times been reached contains seven words, and falls one short of the requisite number by an infringement of the rules governing the puzzle. After the seventh word there is something very like a big "if" left, which may or may not be construed into a hint.

A Lamprey's Nest.

One day late in spring, as I was passing over a bridge, I chanced to see two lampreys, or "lamper-eels," as they are usually called, engaged in building their nest in the creek below me. It was one of the most curious spectacles I ever saw in our stream. They were a few yards below the bridge, just where the water breaks from the still pool beneath it, and flows with a rapid current over its roughly paved bottom. They were distinguishable from the yellowish brown and black stones and pebbles amid which they were working only by their motions. They were tugging away at the small movable stones with great persistence. I went down to the water's edge where they were within the reach of my staff, the better to observe them. They would run up to the edge of the still water and seize upon the stones with their suction mouth and drag them back with the current and drop them upon their nest. I understood at once why their nests, which I had often observed before, were always placed at the beginning of a rift; it is that the fish may avail themselves of the current in building them. The water sweeps them back with the pebble in their mouth, their only effort being in stemming the current to seize it. They are thus enabled to move stones which they could not stir in still water.

The stones varied in size from a walnut to a goose egg. When one of them was tugging away at a stone too heavy for it, I would lend a helping hand with my staff; I would move the stone along gently, and the lamprey seemed

entirely unconscious of the fact that it was being helped; it would drop the burden at the proper point, and run up for another. Indeed my aid and presence did not disturb them at all. From time to time, the larger of the two, which was the female, would thrust her tail with great violence down among the pebbles at the bottom of the creek and loosen them up, and set free the mud which the current quickly carried away. The new material thus plowed up was carried to the nest. Twice in the course of the half hour that I observed them, the act of spawning took place.

Besides helping move the larger stones with my staff, I several times plowed up the bottom with its point, thus relieving the female of that duty. The fish took it all as a matter of course, and seized upon the pebbles I had loosened with great alacrity. When I thrust my cane beneath them and tried to lift them out of the water, they would suck fast to the stones and prevent me; but they did not manifest any alarm. The lampreys become much exhausted with the spawning and nest building, and large numbers of them die when it is over. In June it is not unusual to find their dead bodies in the streams they inhabit.—*Century.*

Our Book Table.

Poultry Diseases: Their Prevention and Cure. By H. H. Stoddard, Editor of *The Poultry World,* author of "An Egg Farm," etc., etc. Price, 25 cents. Hartford, Conn.

This little work is by a practical man, and we have been very much pleased with its directness and simplicity. While it is true in the case of poultry, as of all pets, that cleanliness, good feed and attention to the ordinary rules of hygiene are worth all the drug stores on the Continent, still it is also true that, in spite of these, occasionally a valuable fowl will show symptoms of disease, which, if taken in time, may be cured. As for common fowls, it hardly pays to fuss with them; when they are sick, separate them from the rest of the yard, give them proper food and quietness, and in many cases they will get well. If they die of disease, be sure to either burn or boil them thoroughly, if the disease is of a malignant character. Burying is not safe, even at six feet, for the miserable earth-worm will go down, bring up the germs of disease to the surface, and then, when eaten by the other fowls, they will infect the whole flock.

We are glad to see that Mr. Stoddard places special stress on the necessity for prevention, and lays down simple and accurate rules on the subject.

Scientific Proceedings of the Ohio Mechanics' Institute.

In addition to the regular proceedings, this volume contains valuable papers on Pumping Engines for Public Water Supply, by John W. Hill, M.E.; Comparative Economy Tests of the Gearing Boiler Furnace, by John W. Hill. M.E.; Average Weights of Men and Women, by W. A. Collord; A Criterion for the Measurement of the Speed of Chemical Action, by Robt. B. Warder; Urech's Investigation of the Speed of Inversion of Cane-Sugar, by Robt. B. Warder; The Aurora Borealis of April 27, 1882, by Chas. G. Boerner. The publication is a great credit to the Institute of our sister city. Unfortunately the Institute of similar constitution in New York (The American) publishes no proceedings of its own, and no author of a valuable paper would read such before it, because his doing so would simply prevent recognition elsewhere, and would thus result in burying it.

Correspondence.

A Cheap Battery.

Ed. Young Scientist—I have found that by taking a common fruit can and filling it about three-quarters full of a saturated solution of common salt, and then putting about a tablespoonful of salt in the bottom, so as to keep the solution saturated, placing upon this a piece of any kind of paper, and then laying upon the paper a piece of common coke, taking care that the coke does not touch the can at any point, and then attaching a wire to the can and another to the coke, quite a constant though weak battery is obtained. I have one that has been in constant use for over a week, the circuit being kept complete all the time. With four cells you can decompose acidulated water, salt and water, etc.; also deflect the needle of a galvanometer very readily, and try a number of very interesting experiments. The cost of the battery is very little, being from a cent to two cents a month at the outside.

W. C. Foster.

Scientific News.

—Gen. W. H. Hazen, of the Signal Office, invites people to send him all sorts of popular weather proverbs and prognostications.

—There have been set up in the Grand Opera House at Paris a number of mirrors, measuring 45x52 ft., and weighing from 1,200 to 1,600 lbs.

—The Washington monument is fast getting to be a big thing. It is now over 300 feet high. When completed it will be the highest piece of architectural work in the world.

—A French chemist has analyzed the juice of the so-called milk tree of Central America, to the

nutritive qualities of which attention was first drawn by Humboldt, and has found that the vegetable product really possesses many of the characteristics of cow's milk.

—Eighteen young ladies who graduated at the Boston Institute of Technology last year have found lucrative positions as designers in chintz, calico, wall paper or floor coverings.

—Those who yet cling to the old-time faith in the moon's influence upon the weather may be interested to learn that so eminent a scientist as Sir William Thomson has recently felt called upon to declare that careful observation with the barometer, thermometer and anemometer have failed to establish any such influence, and have proved, on the contrary, that if there is any dependence of the weather upon the phases of the moon it is only in a degree so slight as to be quite imperceptible to ordinary observation.

—A mining superintendent at the West says that by the use of the chronograph he ascertained the fact that the long pump-bobs in his mine moved down at the top before they stopped coming up at the bottom—that is, they went both ways at once. This seems absurd, but is rational, for the pump-bob being 3,500 ft. long, and made of wood, some time elapses before motion at one end is transmitted through to the other. It would be interesting to know exactly where the neutral point is.—*Mechanical Engineer.*

—Mr. Jardine, M.P., has recently had erected in the grounds at Castlemilk, England, a sun dial of extraordinary dimensions. It consists of a large twenty triangular-sided stone, supported on a pedestal thirteen feet high, and is after the style of Queen Mary's dial in Holyrood grounds. There are fifteen dials. Two indicate Greenwich time, two tell the time of night by the moon; the others indicate the rising and setting of the sun, the length of the day, tell when it is noon at the principal places over the globe, the sun's declination, etc.

—Prof. M. W. Harrington refers to two kinds of changes on the moon's surface which may be regarded as fairly established. The first is the land slides, which may doubtless be caused by the great alterations of temperature to which the moon is subject. Many of these slides may be easily recognized with good telescopes. The second form of change is illustrated by craters, which have been proven to be different in size and shape from what they were recorded by earlier observers. Many other changes have been suspected, but they are of a more uncertain and doubtful character.

—The Editors of *The American Naturalist* desire information as to whether honey or other bees are carnivorous, and publish some notes showing that they lap the juice of fresh meat. In this country at least, one, if not several, honey bees have been noticed by a reliable observer resting on a piece of meat in a butcher's shop in Providence, R. I., and lapping with their mouth-parts the fresh meat, apparently feeding upon the juice of the beef. Dr. H. Mueller also contributes to the same magazine his brother's (Fritz Mueller) observations on carnivorous bees, and shows that not only wasps, but also numerous honey and wild stingless Brazilian bees, species of Melipona and Trigona, have been observed by him in Brazil. Any information of a similar nature, if carefully made, is desired. It is possible that bees may not actually eat raw flesh, though wasps are known to do so, but simply visit exposed meat to sip the sweet juice, just as butterflies are known to be attracted by decaying fish, and lap or suck in the fluid standing on the fish.

Practical Hints.

Red Ants.—The judicious use of oil of turpentine will effectually exterminate red ants. It may be injected into cracks and crevices in closets and elsewhere from an ordinary sewing machine oil can.

Preservation of Game.—*Forest and Stream* gives sportsmen this advice: "Kill the owls; kill the hawks; kill the foxes; kill the skunks; kill the red squirrels. Remember that this destruction of vermin means something toward the preservation of the game supply."

Frosting Brass Work.—The *English Mechanic* gives this formula for frosting brass work to give it an ornamental finish: "Boil in caustic potash, rinse in clean water, and dip in nitric acid till all oxide is removed; then wash quickly, dry in boxwood sawdust, and lacquer while warm."

Stove Blacking.—It is said that the most lasting polish is obtained by first brushing the stove with a syrupy mixture of lampblack and soluble glass, and letting dry for twenty-four hours. Then apply a syrupy mixture of blacklead and mucilage, and polish by brushing before the last coat dries.

Black Leather-Varnish.—A black leather-varnish, which is said not to crack or peel off, may be prepared thus: Rosin, 30 parts; turpentine, 30 parts; oil of turpentine, 30 parts; sandarac, 60 parts; shellac, 120 parts; alcohol (90 per cent.), 900 parts. Digest, then add lampblack, 15 parts, previously triturated with a little alcohol.

Salicylic Acid in Wooden Vessels.—The preservative and antiseptic action of salicylic acid cannot be relied on when brought into contact with any liquid substance in wooden vessels or casks. The salicylic acid under these circumstances speedily disappears, being apparently absorbed and decomposed by the wood tissue. When this acid is used as an addition to drinking

water or wine, the cask must first be coated with pitch.

Restoring Frozen People.—Medical men have always differed as to whether the best treatment of frozen persons was by a gradual or rapid application of heat. To settle the matter, Laptchinski has made a series of very careful experiments upon dogs, with the following results: Of twenty animals treated by the method of gradual resuscitation in a cold room, fourteen perished; of twenty placed at once in a warm apartment, eight died; while of twenty immediately put into a hot bath, all recovered.

Hard Putty.—The *Carriage Monthly* gives the following for a hard putty that will dry in one day: Take the whitening, mash all the lumps out on the stone, and mix into a stiff paste by adding equal parts of japan and rubbing varnish; then add as much keg-lead as you think will make it work free with the knife; then add the rest of the whitening until you have it to suit you. This will sand-paper good with one day's drying. If you want putty that will dry quicker, take dry white lead and mix with equal parts of japan and varnish, to which add a few drops of turpentine. This is very soft for puttying, but can be sand-papered in from two to three hours, it becoming perfectly hard in that time.

Label Varnish.—An excellent varnish, which dries in a few seconds, and produces a colorless, smooth, and shining coat, is prepared, according to R. Kirsten, from the following:

Sandarac	53
Mastic	20
Camphor	1
Oil of lavender	8
Venice turpentine	4
Ether	6
Alcohol	40

The ingredients must be macerated for weeks, until everything is dissolved. It is, therefore, advisable to prepare a sufficient quantity to last for some time at once.—*Pharm. Zeit.*, 1881, No. 13.

Bismuth in Soft Solders.—The fusibility of soft solders is increased by adding bismuth to the composition. An alloy of lead four parts, tin four parts, and bismuth one part is easily melted; but this alloy may itself be soldered with an alloy of lead two parts, bismuth two parts, and tin one part. By adding mercury a still more fusible solder can be made, but the strength of the solder is greatly lessened. Equal parts of lead, bismuth, and mercury, with two parts of tin, will make a composition which melts at 122° F., or an alloy of tin five parts, lead three parts, and bismuth three parts will melt in boiling water. In mixing these solders, melt the least fusible metal first in an iron ladle, then add the others in accordance with their infusibility. To cast strips of solder, pour a thin stream of the molten metal on a flat surface of stone or metal.

Notes and Queries.

In continuing this department, which has been found of so much value, we would remind our readers who wish for information on any of the arts and sciences, that they are cordially invited to make their wants known through this column, and those of them who can furnish accurate answers to questions asked are requested to send in replies. Doubtless many of our subscribers may know of methods, processes, or devices that may be better or more suitable for the particular case in question than anything generally known, and it is this reason that induces us to keep this department open for a medium, where an interchange of ideas and practices may be made to the advantage of all our readers. Correspondents will please send their full address when forwarding their communications—either questions or answers—not for publication, unless expressly so stated, but so that we may know where to find the writer if desirable. Communications should be sent in on or before the first of each month previous to publication, to insure insertion in next issue.

Answers.

In answer to R. G. (1).—Cathay is China; and as China is not looked upon as a particularly progressive country, the poet means to intimate that mere existence in Cathay during a whole "Cycle," or 25,000 years, would not be as full of real *life* and incident as fifty years in America or Europe. (2). The "Swiss Family Robinson," is an abridged translation of a German tale by Humbolt's tutor, Joachim Heinrich Kampe.—S. K.

12. S, N. will find that the drying and curing of skins is not a pleasant process, but many small kinds may be made useful should their owners know what to do with them, and will undertake the trouble. If the skin has already been dried, soak it in clean, and if possible, running water for twenty-four hours, working it with the hands repeatedly during the time, until it becomes quite soft. If the skin is soft and fresh, it will only need washing to remove the dust and dirt, and careful scraping to remove any particles which may have adhered to the skin. Allow the soaked skin to drain until most of the moisture has left it; then lay it on a firm table with the hair underneath. Prepare the following mixture, and apply as directed: Alum, 5 lbs.; salt, 2 lbs.; coarse wheat, oats, or corn meal, 2 lbs. Powder all the ingredients carefully, and mix gradually in a stoneware jar, or wooden bucket, with enough sour milk or sour buttermilk to bring it to the consistency of cream. Then, taking some of it, rub it thoroughly into every part of the fleshy side of the skin, using as much force as possible to drive the mixture into the pores. Give the skin as much rubbing as possible. Repeat this process daily for eight or ten days, laying the skin away each night, with plenty of the mixture to cover it, and folding it together with the fur side outwards. When it appears sufficiently tanned, wash as at first, in clean water, repeating the washing until there be no salt left in the skin, because, if any be left, the skin will grow damp on every moist day. The last process is to apply a strong solution of alum without salt, and lay the skin to dry, exposed to the sun, if possible. When dry it will be as hard as a board. Now roll it up into a tight roll, with the fur outside. Take a wooden mallet and beat it till it becomes less stiff. Open it out and stretch it as follows:—Get any blunt instrument with a rounded edge—a large shoemaker's rasp, for instance—and, laying the skin on the floor, proceed to work it from the centre to the sides with the blunt end of the tool, steadying the skin by placing the foot upon it, using the tool with the right hand and holding the skin with the left. When thoroughly worked all over, smooth with pumice-stone, and it is finished. The foregoing recipe is an excellent one, and easy to follow. I have seen handsome rabbit-skin rugs, made of skins cured by this process by the younger

brothers and sisters of a large family, and in one instance I saw a lady's cloak with a fur lining, the skins of which had been prepared by the brother of the lady to whom the cloak belonged.—AMATEUR.

13. To "Victor."—In making choice of woods for inlaying, several things have to be taken into consideration, namely: the purpose for which the work is intended, the limit of expense decided upon, and the character of the work itself. To the first of these considerations it may be said that if the inlayed work is intended for a cabinet, work-box, jewel case, stand-top, or similar work, then the woods should harmonize in color and texture with the main body of the work. For instance, if a cabinet be made of mahogany, then the inlay in the door, drawers or side panels may be of teak, rosewood, or even lignum vitæ. Sometimes ebony is used for inlaying mahogany, but this, we think, is bad taste, as mahogany color is quiet and unobtrusive, and a black inlay makes too strong a contrast. To the second consideration we may say that if expense is no object, ebony and satin-wood make a very chaste combination, and look exceedingly rich, if the design is appropriate and the work done well. Do not use holly with ebony; the holly soon becomes weather stained and creamy looking if not protected by glass or other covering. Of course, for the finest of work, ivory and ebony combined, if too much of the former is not used, make a pleasing contrast, but to be effective the work must be well done. With regard to the third consideration, if the work is very fine and the design intricate, the woods must be chosen with a view to their strength of fibre as well as to their harmony of color; if, on the other hand, the design is large and simple, then the cross-grained woods will answer very well. Ash and walnut, oak and walnut, walnut and cherry, walnut and rock maple, mahogany and rock maple, or amaranth and rock maple, will make very handsome combinations when properly handled. Oak and walnut, the former being the inlay, has a very quiet and pleasing effect.—F. T. H.

14. To bleach skeletonized leaves "Nellie" should proceed as follows: Having first taken the pulp all from the leaves, take four ounces of chloride of lime, and a pint and a half of cold water, mixed. When settled, pour off the clear liquor and cork up closely in a bottle. Procure a wide-m uthed jar, and put a teaspoonful of this bleaching liquid to half a pint of water, and in this immerse the leaves until they become white. They should then be washed carefully in cold water and dried on white blotting paper, then gently pressed flat, and placed away and labeled.—S. N.

15. The following is offered to R. T., on the coloring of leaves in Autumn. It is taken from a new work on "Forest Tree Culture": "The coloring of autumnal leaves appears to be due to the formation of organic acids from the absorption of oxygen, and caused by a ripening process, similar to that which colors ripening fruits. It is not the effect of frost, as many people believe, but may be hastened by the cool nights alternating with warm days, that often occur in autumn. The autumnal coloring of European forests is sometimes bright, but never as brilliant as in our Northern States and Canada. Its prevailing colors are yellow, shading off into tints of pale orange and reddish brown, while in our Northern forests it is often the brightest scarlet and orange, a rich golden yellow, or an intense purple, but all passing gradually into a nearly uniform shade of brown."—S. N.

16. R. W., Andover, N. Y.—Send to Chas. E. Little, 59 Fulton St., New York, for his scroll-saw catalogue.

17. J. N., Philadelphia.—The following engravings show a design for a self-acting fountain: Fig. 1 shows a finished and decorated design of fountain. Fig. 2 shows a basin A, and two cisterns B and C; to start the fountain, water is poured into basin, and runs through pipe D, filling cistern C, and leaving basin half full, the tap in pipe E is then turned, shutting off the only escape for the air, leaving only the way in through

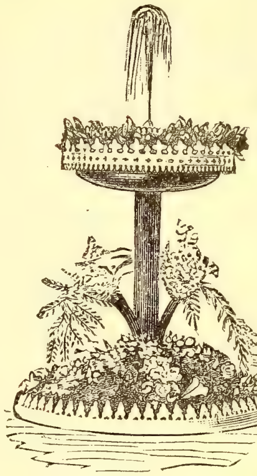


Fig. 1.

pipe D, and the way out through pipe F; now take the small bent tube H, placing one end in pipe D in basin, and blow for half a minute; this will drive the water out of cistern C, through pipe F into cistern B. While the water is passing into cistern B, the air is escaping through pipe E

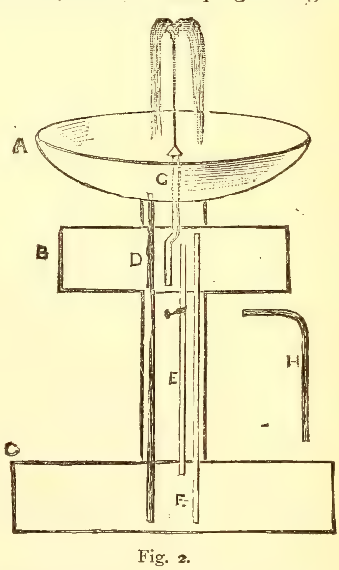


Fig. 2.

(replacing the water in C) by the tap, which acts as a vent as well as a shut off from cistern. Cistern C is now empty, and cistern B full, and the fountain ready for playing—turn the tap, the water will then pass from the basin, through pipe D into cistern C, driving the air through E, and pressing on the water in B, drives it through the

jet G. When done playing, turn off the tap, place the bent tube H into pipe, and blow as before; turn the tap and the fountain will recommence. Of course everything about this must be made tight and perfect, to insure success. The tanks and basin may be made of zinc or other similar metal.—X. Y. Z.

18.—In answer to the request of F. E. F., Lancaster, Pa., I send the enclosed designs for monograms. The combinations are simple, easily made, and are admirably adapted for scroll sawing and inlaying.—U. S. NAVY.

19. S. O. G.—Æsthetic is a word of many meanings at present. In the end we think it will mean a great improvement in all our surroundings in daily life, and a greater knowledge of what is beautiful and true in ourselves, our houses, and our dress. The dictionary says, "Æsthetics: perception of the beautiful."—SUSIE.

Queries.

20. BIG BOY, Utica, N. Y.—Thanks for your answer to my query, No. 8, about wood-carving, given in last month's YOUNG SCIENTIST. I shall make use of the information to the advantage, I hope, of myself and brothers. May I apply again for information, and ask of you, or some of your readers who may be able, to give the etymology of the word "derrick?"

NOTE.—Derrick, according to Webster, was originally an abbreviation of Theodoric, which in old Saxon was made *Detrich*, and in German *Dietrich*. Derrick, as now used, means simply a temporary crane, and is mostly used by builders and quarrymen. It was so called from Derrick, a celebrated Tyburn hangman, who lived early in the Seventeenth Century, during Queen Elizabeth's reign, and who beheaded the Earl of Essex in 1601. The term used to be an equivalent of "gallows."

21. MATILDA, Newark, N. J.—I desire to know what flowers and trees were dedicated to the heathen gods by the ancients, and also, if trees flowers or shrubs were ever dedicated to any of the saints in the Christian church. Any information on this subject will be duly appreciated.

22. TOM H., Providence, R. I.—Will some reader explain what is meant by a "divining rod," its uses, etc.?

23. MONOGRAMS.—J. H. P., Brooklyn, N. Y.; T. W. T., Philadelphia, Pa.; and S. N. B., New Britain, Conn., desire monograms of the letters sent. Will some of our clever readers send us in for reproduction combinations of the above letters. Use good black ink on smooth white paper.

24. NINA, Toledo, O.—There is a method of transfering colored prints to glass, and giving them a semi-transparent appearance. Will some reader of the YOUNG SCIENTIST inform me how the work is performed, and oblige?

25. TRANSIT OF VENUS.—ROBERT H., Boston, Mass.—Will the Editor of the YOUNG SCIENTIST, or some competent reader inform me why so much "fuss" was made about the "Transit of Venus," its significance, and how the results are obtained?

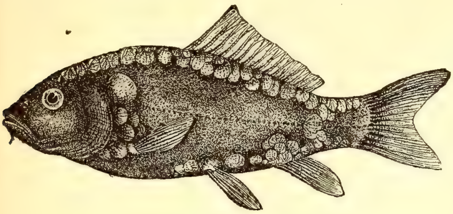
NOTE.—We take pleasure in referring Robert H. to an article on another page by Prof. Berlin H. Wright, whose skill in making abstruse astronomical problems clear to the most common minds is well known. This article on the Transit of Venus covers, we think, the whole ground embraced in the questions asked. A careful reading of the paper cannot but result in conveying valuable information to the uninitiated in matters of astronomy.

Market Report.

The German Carp.

Foremost amongst the novelties offered to our young friends this season is the German carp. This now famous fish was originally found in the large rivers of Germany, where many years ago, by careful cultivation, selection and breeding, it was greatly improved in flavor, size and habit. Several new and greatly improved breeds have also been produced. The varieties best known in this country are the scale carp, leather carp, and mirror or king carp, which is the most highly prized of all varieties of carp, either native or foreign, its flavor, when bred under proper conditions, ranking very high amongst fresh-water fishes. The German carp has been introduced as a table fish throughout Europe, Asia and Australia, and since the spring of 1877 up to the present time, large numbers have been distributed to all parts of the United States by the U. S. Fish Commissioners at Washington. The first importations of the German carp were brought over from Germany by the German fish culturist, Her von Hessells, and were planted in the U. S. Commissioners breeding ponds at Washington, whence, as they increased in numbers, they were distributed to the fish commissioners of each State, who again distributed them to all persons having suitable ponds, either natural or artificial, wherein to breed them; not for ornamentation or for the aquarium, but for the purpose of increasing the food supply of edible fish and reducing the cost of this article. All the varieties of the German carp are remarkably tenacious of life, and will undergo sudden and severe changes of temperature, as a rule, without injury. In moist and cool weather the leather and looking-glass carp can be transported alive long distances in what is known, among fish culturists, as "dry packing," which consists of a packing of damp moss. The food of the carp is entirely of a vegetable nature, and, curious to relate, the leaves of tender and crisp lettuce is a favorite diet with our foreign fish friend, also bread, boiled potato parings, rice, and the green scum that forms and floats on the surfaces of standing ponds, or grows on the stems and leaves of aquatic plants; all these he devours with much gusto. In fact, all vegetable refuse is acceptable to this very interesting fish. From the first importation of the German king carp I obtained some six small specimens no larger than the one shown in the

illustration. These, after being well fed every day for a period of two years and a half, attained the size of six inches, and had they been in a pond, instead of a comparatively small aquarium, the increase would have been still greater. In course of time they become so tame that they



GERMAN CARP.

would feed from my hand. It is best to obtain a few of them when very small, and bring them up the first year in an aquarium; in this way you can break them in so that when set free in the pond they will, by their example, teach the wild carp to feed from your hand without fear.

I can not imagine a more profitable and pleasant investment of a small amount of capital and time, for young men whose parents are owners of or are interested in fresh-water lakes or ponds, than to address a letter to Professor S. F. Baird, U. S. Fish Commissioner, Washington, D. C., giving a description of the body of water over which they have control, and the proper number of carp needed for stocking said pond. In this way you can obtain all information required to obtain the carp free of all charge, except the can for transportation and cost of transportation. The accompanying illustration of the mirror or king carp was taken from a living specimen kindly furnished by Fish Commissioner of New York State, Eugene Blackford, who is now distributing young carp bred in the government breeding ponds at Washington.

The Golden Ide.

A very beautiful and graceful fish, closely resembling in form and size our fresh-water roach, has lately been imported from England. This fish is of a uniform delicate reddish-orange color, similar to that of the gold fish, but more delicate. These beautiful strangers are to be sent to the Washington breeding ponds, and also to the experimental ponds at Cold Spring Harbor, Long Island. It is thought that they will never attain a size greater than from four to six inches, and should this be the case, the gain will be great for our young scientists, as they will have a far more beautiful fish for their fresh-water aquaria than even the pretty gold-fish.

Retail Prices.

IMPORTED CAGE BIRDS.

Canaries, *Belgian*, per pair	$6.00 to 15.00
" *French*, each	8.00 to 15.00
" *German, Hartz Mts.*, each	2.50 to 10.00
Gold Finches, each	1.50
Gold Finch (mules), each	2.50 to 5.00
Bull Finches, each	$2.50
Bull Finches (tuned), each	10.00 to 40.00
African Finches, per pair	2.50 to 5.00
Chaf Finches, each	1.50
Linnets, each	1.50 to 2.00
Linnets (mules), each	1.50 to 2.00
Green Linnets, each	1.50
Java Sparrow (blue), each	1.50
Java Sparrows (white), each	4.00 to 6.00
English Sparrows, per pair	1.00
Siskins, each	1.00
Gray Cardinal, each	4.00 to 5.00
Nightingales, each	8.00 to 25.00
Japanese Nightingales, each	5.00 to 10.00
Thrushes, each	5.00
Skylarks, each	5.00
Troopials, each	7.00 to 12.00
European blackbirds, each	5 00
Black-caps, each	4.00
Starlings, each	4.00 to 6.00
Ring Doves, each	2.50 to 3.00

AMERICAN CAGE BIRDS.

Canaries, each	2.50
Mocking Birds, females, each	1.00
" " singers	12.00
Robins	2.50 to 5.00
Blue Birds ("Blue Robins") each	1.50 to 2.00
Indigo Birds, each	1.00
Nonpariel, each	1.50 to 2.00
Virginia Cardinal, each	3.00
Bobolinks, each	1.50 to 2.00
Yellow Birds, each	1.50 to 2.00

QUADRUPEDS.

Terriers, *black and tan*, each	5.00 to 30 00
Terriers, *Scotch and Skye*, each	5.00 to 30.00
Newfoundland Pups, each	10.00 to 15.00
Pomeranian or Spitz "	5.00 to 15.00
Greyhounds, *English*, "	10.00 to 25.00
Greyounds, *Italian*, "	10.00 to 30.00
Guinea-Pigs, *common*, per pair	1.50
" " " large	1.50 to 3.00
Guinea-Pigs, *all white*, "	2.00 to 4.00
Squirrels, *gray*, "	5.00
Squirrels, *all white* "	15.00 to 25.00
Squirrels, *flying* "	3.00 to 4.00
Squirrels, *small red* "	2.00
Rabbits, *common*, per pair	1.00 to 2.50
Rabbits, *fancy breed*, according to age and purity of breed, per pair	3.00 to 15.00
Ferrets, *English*, "	15.00
Raccoons, each	4.00 to 5.00
Cats, *Maltese* (males), each	5.00
" " (females), each	3.00
Cats, *Albinos, pink or blue eyes*, each	3.00 to 5.00
Rats, *white China, pink eyes*, per pair	1.50
Rats, *piebald*, per pair	1.50
Mice, *white, pink eyes*, per pair	0.50
Mice, *piebald*, per pair	0.50
Fine Shells for Fancy Work, according to colors and variety, per quart	1.00 and up.

Prices Paid for Pet Stock by Dealers.

At this season of the year the prices paid for pet stock of all kinds are very low; this is on account of the demand for said stock falling off greatly after the holidays. Rabbits (common) are now ranging from 50 to 75 cents per pair, according to age and color.

Guinea-Pigs, per pair	$0.40 to 0 75
Squirrels, *gray*, each	0.50 to 1.00
Squirrels, *flying*, per pair	0.25 to 0.50
White mice, per pair	0.15 to 0.20
Aquarium fish *(now scarce)* per hundred	1.50 to 2.00
Gold Fish *(now scarce)* per hundred	8.00 to 10.00
Aquarium Plants *(now scarce)* per hundred bunches	5.00
Small Marine Shells for Aquaria, per quart	0.50

For all information on this subject, as to reliable dealers, etc., etc., send postal card to YOUNG SCIENTIST,

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business matter in letters or cards they are filed away and never reach the printer.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

Bee Hive wanted; one of the old-fashioned straw "skeps"; say what you would like in exchange. Apis, care of Young Scientist, 49 Maiden Lane, N. Y.

A first-class type writer, in excellent condition, cost $125.00, to exchange for good microscope, telescope, or valuable scientific books; send full particulars. A. B., Box 114, Lewiston, Maine.

A $30 stencil outfit (Spencer's) for a self-inking printing press in good condition, chase about 6 x 9; rich ores and minerals of Idaho for scientific and instructive books, printing press, type, etc. J. P. Clough, Junction, Lemhi Co., Idaho.

Wanted pyrites of iron from Colorado gold mines in exchange for sea shells and other gems; send list of what you have to exchange. S. Ferguson, Eureka Springs, Arkansas.

Scientific specimens of various kinds for same. Geo. E. Frazier, Caldwell, Ohio.

A banjo in good condition, two pairs of rosewood bones, three splendid games, and a fine set of drawing instruments, for a good cornet, viola, violincello or double bass. L. B. Hill, Kalamazoo, Mich.

A good telescope, also foot-lathe and saw combined, each worth $10.00, for shells, fossils or relics. Independent, Conncautville, Crawford Co., Pa.

Birds' eggs to exchange for others; send list of what you have to exchange. Emil Laurent, 621 Marshall St., Philadelphia, Pa.

Lester W. Mann, Randolph, Mass., Box 162, has Demas scroll saw, lathe and tools, emery wheel; $20 worth patterns; Smithograph; large harmonica, cost $1.75; novelties in seeds; for large self-inking press or offers.

10 volumes Chambers' Encyclopædia, American Book Exchange edition (cloth); Bonanza printing press, chase 3 x 5, card type, ink roller; spyglass, power 10 times; for French triplet, 1-5 in., or offers. H. P. Nichols, P. O. Address, Bridgeport, Conn.

Twelve or fifteen volumes of the American Agriculturist to exchange for scientific books or offers. W. H. Osborne, Chardon, Ohio.

J. D. Rice, P. O. Box 473, Trenton, N. J., would be pleased to correspond with mineralogists for the purpose of exchanging specimens and ideas.

To exchange, my collection of nearly half a thousand rare postage stamps with catalogue, for second-hand Flobert rifle; must be in good condition. H. E. Whitman, Station M, New York.

I have a large assortment of foreign stamps to exchange, also Confederate money. Collectors send sheet and I will return it with mine. Box No. 2, Coeymans, N. Y.

Electric bell engine, cost $15; pair of analytical scales, cost $10; pair of Bell Telephones to exchange for a printing press, watch or offers. Geo. N. Bigelow, Box 754, Palmyra, N. Y.

Any person wishing to trade bird's eggs may apply to me and I will send them my list of bird's eggs. I have only a few at present, but am receiving a number every month. A. G. G., Box 26, Summit, New Jersey.

Minerals of Idaho for Standard Works on the Horse—Wallace's Registers and turf journals. Wanted, also other useful books, bound and in good condition. Many varieties named in my list. J. P. Clough, Junction Lemhi Co., Idaho.

To exchange for offers first four (fifth when completed) bound volumes of YOUNG SCIENTIST. J. N. Brooks, P.O. 1468, N. Y. City.

Wanted engraver's tools with book of instructions, for a Victor Press, with cabinet, 2 type cases, type, ink roller and furniture complete; perfectly new. L. Warren, 72 Cumberland St., Brooklyn, N. Y.

A Fletcher Foot-Blower, cost $5, as good as new; will exchange for a Cushman, 2 in. or up scroll chuck, or other make; will give a satisfactory trade on the difference in price, if any. Louis Lutz, St. Clair Street, Toledo, O.

I have a lot of "Galaxy" (magazines) which I would like to exchange for an air rifle in good condition, a collection of birds' eggs, or offers. W. B. Greenleaf, 480 La Salle Ave., Chicago, Ill.

I have a Mechanical Telegraph with book of instructions, books, etc., which I wish to exchange for good microscopical objects, mounted on 3 x 1 slips. Address, with list, J. H. Frey, Millersburg, Ohio.

To exchange, "How to Use Microscope," Wells' "Natural Philosophy," and many other books, chemical apparatus, etc., for good photographic camera, and lenses. W. H. Weed, 254 Putnam Ave., Brooklyn, N. Y.

Wanted "Quimby's New Bee Keeping," for "Our Own Birds of the United States," by W. S. Baily; new. Joseph Anthony, Jr., Colota, Whiteside Co., Ill.

Wanted a good book in anatomy, in exchange for a book on chemistry, or for story books. A. G. G., Box 26, Summit, New Jersey.

A German-silver trimmed, patent lined, cocoa flute, cost $4, in good order, for good spy-glass, photo-material, or offers. Ewing McLean, Greencastle, Ind.

I have some fossil shells from the west bank of the Mississippi, to exchange for Indian relics. A. W. S., 187 E. 71st St., N. Y.

I have a magic lantern, Ruby pattern, nearly new, and 5 views; also "Our First Century," bound in leather, cost $7; state what is wanted in exchange. I. N. Spencer, Box. 217, So. Manchester, Conn.

First-class telegraph instrument and attachments, and "Wood's Botany," for bound volumes of periodicals, books, or offers. H. P. Albert, Anderson, Iowa.

Wanted a book on treatment and care of canary, also breeding of same; will give in exchange book named "Market Garden, Flower Garden and Bees," or 40 "Scientific Americans" or "Seaside Libraries;" want also old books. M. J. Mulvihill, Norwalk, Conn.

Coins, minerals, stamps, books, type, fishing tackle (very complete) and fish pole, bronze inkstand, etc., for coins, medals, stamps, war envelopes, old newspapers, and Continental, Colonial and Confederate currency. F. F. Fletcher, 103 Main St., St. Johnsburg, Vt.

Blow-pipe set (cost $10), large illustrated family Bible (cost $7.50), for Wood's Botany, Dana's Geology, or printing press and type. H. W. Noble, Box 134, South Dansville, N. Y.

Wanted, offers for fossil shells from the west coast of Africa. A. W. Seward, 187 E. 71st St.

I have a number of birds' eggs I should like to trade for other birds' eggs; send for list of trading eggs. A. G. G., Box 26, Summit, New Jersey.

For a microscope stand or offers, a 36-inch turning lathe (new) and a number of scientific books; send for list. A. Kendall, Somerville, Mass.

Wanted services of amateur printer with small office (or large), in exchange for an interest in a well-established weekly paper, good size. Eagle Office, Plymouth, N. H.

American Agriculturist microscope, new, cost $15, for amateur photographic apparatus, lever watch, 22 calibre breech-loading sporting rifle or magic lantern of equal value. Wm. A. Walker, Rockland, R. I.

I. T. Bell, Franklin, Pa., has back numbers of Scientific American, Forest and Stream, and Young Scientist, good flute, chessmen, books, etc., for good magic lantern, revolver, scarce coins, or offers.

For self-inking printing press and type, one Henry rifle, 16 shot, 44 cal., cost $40, in good order, or one double barrel shot gun, barrels London fine twist, or offers. J. B. Garrison, Belton, Bell Co., Texas.

The Young Scientist

SCIENCE IS KNOWLEDGE. — KNOWLEDGE IS POWER.

INDUSTRIAL PUBLICATI

A PRACTICAL JOURNAL OF

HOME ARTS.

VOL. VI. NEW YORK, MARCH, 1883. No. 3.

Amateur Wood Carving.

BY LEO PARSLEY.

IT is not necessary that the amateur carver should have a thorough knowledge of the various styles of decorative art, still it is desirable that he should have a fair idea of the distinctive features of each style. While it is not the intention of the writer to fully explain each characteristic of every style, it is thought necessary to describe briefly the main features of some of the historic styles of ornament.

Ornamental styles may be broadly divided into two great classes—the *symbolic* and the *æsthetic;* the elements of style are also of two kinds, the pure and absolute, and the conventional and arbitrary; or natural and fanciful. There are also two provinces of ornament—the *flat* and the *round;* in the former we have a contrast of light and dark, in the latter a contrast of light and shade. It is with the latter that we have most to deal with in wood carving, and the amateur should always bear in mind that the two great principles he has to study most particularly are shape and contrast.

In most cases where imitations from nature, such as flowers or fruit, are introduced into a design, they should be used as accessory decorations, and not as principals, otherwise there is a risk of substituting the ornament itself for the object to be ornamented, and in every case ornament is essentially the accessory to, and not the substitute of, the useful. As the motive of ornament is to render the object ornamented agreeable to the eye, the details of the decoration should be kept purely subservient to the beauty of effect. Let me here caution the amateur never to overload his design with a multiplicity of details, as by so doing he increases the labor of production, and at the same time spoils the effect of the design as a whole.

Symmetry is such an important element in decoration that it must never be

disregarded. In art, as in nature, it is the *group* that is the ornament, and not the individual; and this law must be observed by the designer. In clusters, festoons, etc., of fruit or flowers, the individuals may be arranged at random, but the cluster or festoon itself must be of symmetrical proportion.

This law of symmetry is so important that it has been stated that there is no form, or combination of forms, whatever, that when symmetrically contrasted and repeated, cannot be made subservient to beauty—in fact, the whole grammar of ornament consists simply of contrast, repetition and series. I would again impress upon the amateur designer the necessity of scrupulously avoiding an overloading of detail; he should first of all consider utility, making detail merely a secondary consideration, endeavoring at the same time to so group the details or to provide against injury by the skilful adjustment of the relieved portions to the situation, or use of the decorated object.

Taste in design, I need hardly say, is of paramount importance; and no amount of mere mechanical skill can counterbalance the effect of a badly conceived design. Strange as it may at first sight appear, it is nevertheless true, that in no popular style of ornament have purely natural details ever yet prevailed. It is true that in all the great styles, the details are largely derived from nature, but for the most part conventionally treated. A plant or natural object is said to be conventionally treated when the natural order of its growth or development has been disregarded. The distinction between the natural and conventional, or ornamental treatment of an object, should be clearly understood. In Fig. 1 the engraving represents an ivy leaf conventionally treated, and it will be seen, that though the scroll is composed of strictly natural parts, still as no plant could grow in an exact spiral direction, the scroll form constitutes the conventional arrangement.

Every design is composed of two parts—plan and details; as in a bracket, the shape of the bracket is the plan, the decorations of the bracket are the details of the design, and these details may either cover the entire surface of the bracket, or only portions of it. Decorations which

Fig. 1.

uniformly cover the entire surface of an object are usually called diapers, and are commonly composed of a series of the same ornament in a vertical, horizontal, or diagonal order. Diapers, as in Fig. 2,

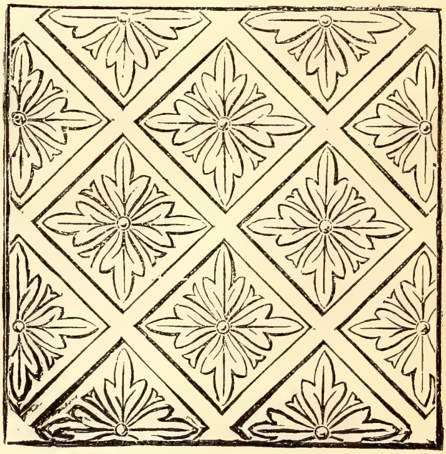


Fig. 2.

are best suited for flat surfaces, and have the best effect when arranged diagonally. The majority of the ancient mosaics are diapers of a geometrical pattern. It appears that the first principle of ornament is repetition; take a moulding, for instance, where we have simply a measured succesion in series of some one detail.

The nine great styles into which ornament may be broadly divided may again be subdivided into ancient, mediæval and

modern. The three ancient styles are the Egyptian, the Greek, and the Roman. The mediæval styles comprise the Byzantine, Saracenic, and the Gothic; and the modern styles are the Renaissance, the Cinquecento, the Louis Quatorze, and the Queen Anne. Style is simply another name for character, and frequently is merely a modification or peculiar elaboration of the details of a previous style. To commence with the Egyptian, we find that many of its forms of ornament are still popular—as the fret, wave-scroll, spiral, and zigzag; but the most symbolic features of this style are the winged globe, the lotus and papyrus, and the asp. Many of the forms, and indeed the very details of the Greek style, are still popular, as they so well represent the great principles of ornament, series, and contrast—contrast of masses and contrast of lines. Some of the principal characteristics of this style are the well-known

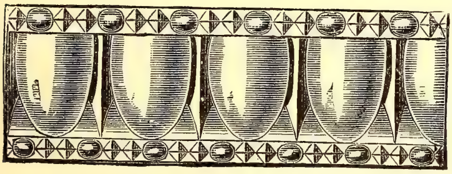


Fig. 3.

espinos, or egg and tongue, as Fig. 3, the astragal, and the scrolls.

In the egg and tongue we get a bold contrast of light and shade, and we have a similar result, though not so marked, in the astragal. It is now, too, that we arrive at carved, instead of painted, ornaments as in the Doric period.

The Roman style is simply an enlargement or enrichment of the florid Greek—

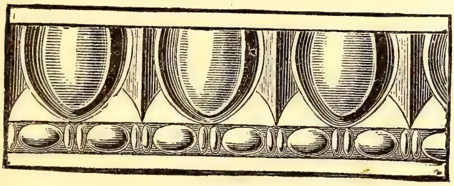


Fig. 4.

in fact, the chief characteristic of this style is its uniform magnificence. As an example of this even in details compare the egg and tongue of this period, Fig. 4, with Fig. 3. The scroll and acanthus are also peculiarly Roman, and continually occur in the ornament of this period—in fact, every form which will admit of it is habitually enriched with an acanthus clothing or foliations. The same may be said of the scroll, which, in the elaborate development with acanthus foliations, is characteristically Roman. The introduction of grotesque forms, like that shown at Fig. 5, belongs to this period.

Fig. 5.

We now come to the middle age styles, in which we find symbols play an important part. Byzantine decorations are in nearly every case composed of ingeniously designed symbolic forms.

In Byzantine art, too, it will be found that all imitations of natural forms, and even animals and the human figure, are conventionally treated. In the decorations of this period it may be noticed that the trefoil and quatrefoil become very frequent, the former being a symbolic representation of the Trinity, and the latter of the Four Evangelists. These symbols are also common in Gothic art. The principles of the next style—the Saracenic—are soon stated. In the designs of this period we find vegetable and animal forms rigidly excluded, and curves, angles, and inter-lacings go to form the major part of the designs, inscriptions

being frequently introduced. This was the period of gorgeous and elaborate diaper decorations, the habit of ornamenting the entire surfaces of their apartments affording a wide field for the display of this branch of art. The third Middle Age style was the Gothic, and this style, perhaps more than all others, should be of interest to the wood-carver.

There is hardly a cathedral where boldly-executed Gothic carvings do not meet the eye. The symbolic elements of both the Byzantine and Saracenic styles are continued in the Gothic, but are chiefly distinguished from these styles by the universal absence of the dome. In Gothic ornament the geometrical and pointed elements are elaborated as much as possible, these elements being also frequently combined with conventional treatment of animal and vegetable forms. This is one of the great features of this style, the tracery in particular being so paramount that some of the varieties of Gothic are almost entirely distinguished by this feature. We have in this style an extensive application of foliage; and the trefoil, or as it is frequently called the Early English leaf, plays an important part, and is a characteristic feature of the ornament. Gothic ornaments, independent of tracery, are nearly exclusively leaves, fruit, or flowers—classical ornaments being excluded; and there is generally a want of finish about the details.

We now come to the Modern styles, commencing with the Renaissance, the principal features of which are intricate tracery and delicate scroll work of conventional foliage. The mixture of various elements is also one of the essentials of this style, men and animals, natural and grotesque, conventional and natural foliage, tracery and scrolls—all forming part of this mixture. The Renaissance in fact is rather a combination of various styles than a revival of any particular style.

Cinquecento is the next style, and this, as a development of art, is the most perfect of the modern styles. The Arabesque scroll work, with its graceful, pleasing curves, is a prominent feature of this style, and with this it combines unlimited choice of natural and conventional imitations from both the animal and vegetable kingdoms, either arbitrarily disposed or combined. All the efforts of this, the culminating style in ornamental art, are made to attain the most attractive results and to gratify the eye. The Louis Quatorze style shows great contrasts of shade and light, and to obtain this result exact symmetry in the parts were no longer essential; consequently, in some examples of this period we find symmetry avoided both in the balance of the whole and in the details of the parts. The individuality of this style is in the constant and peculiar combination of the scroll and shell, the other elements of the style being classical. We find also that the broad acanthus foliations have become more elongated, and that flat surfaces are not admitted into any of the designs of this period—in fact, as sudden and varied contrasts of light and shade are so essential to this style, all the ornamental details are either concave or convex.

The Queen Anne style (so called) is simply a mixing of styles, and possesses no marked distinctive features. Intaglio, sunken or incised work, is the chief characteristic of this style.

The amateur reader will glean from the foregoing some idea of the leading features of each style, and will doubtless be able to distinguish one from the other. In future numbers simple and easy designs, with instructions, will be given, so that they may be executed.

A Wrinkle for Amateurs.

THE difficulty of holding a picture-frame or other mitred work while the corners are being fastened, or the glue setting, has often been the cause of annoyance and irritation to young amateurs. Like most matters of this kind, the trouble ensued more from a lack of knowledge on the part of the workman than from actual difficulties besetting the work. The accompanying engravings exhibit a method by which picture-frames, work-boxes, small writing-desks, glove, collar, or cuff boxes may be held solid until the corners

are fastened—or, if glued—until the glue has set hard. Let *s s s s* be the frame or box; place it on a level surface, such as the top of a work-bench, table, or floor. If the joints, *o o o o*, are to be glued, the stuff must be warmed before the glue is

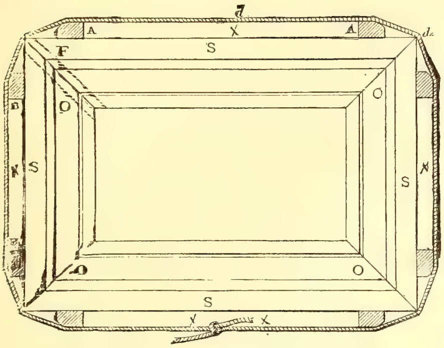


Fig. 1.

applied. Take a strong cord, *d d;* wind it round the frame, as shown, two or three times; prepare eight blocks of wood similar to those shown at A A, B B. If the work is a picture-frame, the blocks need not be longer than the frame is thick, but for a box or other work the blocks may be left any reasonable length. Of course, the cord and blocks must be prepared and tried before the glue is applied, and if any adjustment is required, it must be made at this stage; for when the tightening is once done after the corners are glued the work must not be meddled with until the glue is perfectly hard. Having got everything in readiness, apply the glue, just as hot as possible; slip on the cord as shown; then put in the blocks at *x x x x x*, and slide them along toward the corners, taking care not to slide any one of them too far at first. When the cord begins to tighten, go round the frame again, forcing the blocks nearer to the corners, and repeat the operation until the cord is stretched tight and the joints are closed up. If screws or nails are to be used in the corners, the work must be left until dry before they are driven in; and the driving should be done before the cord is loosened.

Fig. 2 shows the edge of a piece of work, with the cord and blocks, A B, in position. Sometimes the work may be from five to ten or twelve inches deep, and when this is the case, it is better to use two cords—one near the top edge and the other near the lower edge of the box—and

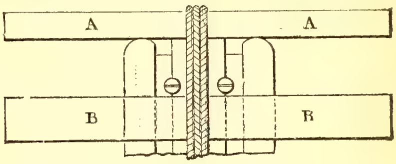


Fig. 2.

have the blocks long enough to pass under both cords; this will insure a pressure at all points on the joint, and will tend to prevent warping and twisting.

The dotted lines shown at F, Fig. 1, represent what joiners and cabinet-makers call a "feather." It is simply a strip of wood the thickness of the saw-kerf, made in the frame, where the "feather" is to go. Care must be used, when running the saw in the wood, to get the kerfs or saw-cuts directly opposite each other. The "feather' must be made with the fibres of the grain running across it. When put in properly and glued, the feather makes a strong, firm joint. Sometimes strips of metal are used for this purpose, but for fine work wood is preferable. This method need only be adopted when strength is a necessity in the joint.

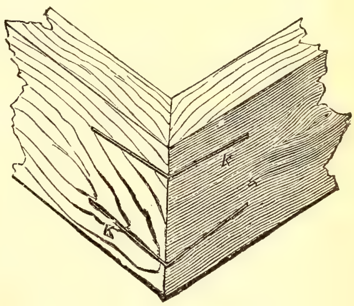


Fig. 3.

At Fig. 3 we show one corner of a box with saw-kerfs in at K K. Strips or feathers are glued in these kerfs, which help materially to hold the corner joint together. It will be noticed that these

kerfs are parallel with the edges of the box; this is the neatest way to put in the strips, and is as strong as any other when the work is neatly done, but sometimes workmen run in the kerfs on an angle, which, to say the least of it, is reprehensible, as the work, when varnished or polished, does not look so well, and is certainly not any stronger than when the strips are put in parallel with the edges.

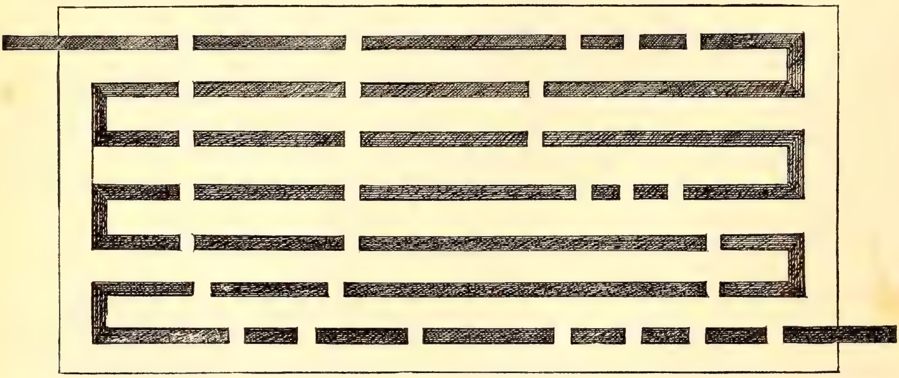
Easy Experiments in Electricity.

WHEN I first took an interest in the study of Natural Philosophy, I wanted to try some experiments illustrating the different phenomena of electricity, but I could find no simple directions for performing them without considerable expense. The object of these articles is to help others in like circumstances to get the same enjoyment and instruction, and save their money for other purposes.

On page 2, Vol. V, of the YOUNG SCIENTIST, are directions for obtaining a spark from a piece of brown paper and a bunch of keys, but you may get a longer spark with the following simple apparatus, which we call the "tea-tray electrophorus." This consists of an ordinary metallic tea-tray, supported by two glass goblets and a piece of brown paper, the same size as the inside of the tray, with a small strip of paper fastened to each end for handles. To obtain a spark, first heat the paper pretty hot, and rub it well with a clothes-brush; then lay it on the tray, hold your knuckle near it, and you will get a spark of negative electricity. Now lift the paper and hold your knuckle near the tray, and you will get another spark, but of positive electricity. I have obtained sparks in this way one and one half inches long, when the conditions were favorable.

To give a sensible shock we must have a condenser, either a Leyden jar or the following apparatus, which, though it costs almost nothing, is quite effective. Take two pieces of sheet tin, 8x10 inches, or larger, and set them on a glass goblet, with a piece of window-glass, a little larger than the tins, between them. Now take a piece of brown paper, warm it, and rub it, as in the electrophorus, lay it on the upper tin, and touch the latter; then raise the paper and touch the under tin, repeat the operation several times, and then, by touching the under tin with one hand and the upper tin with the other, you will receive quite a shock.

The explanation of this is, that when the paper is rubbed it is charged with negative electricity; laying it on the tin, the negative electricity in the paper attracts the positive in the tin, and the negative flows off through the hand to the ground. Then, when the paper is lifted, the positive electricity in the upper tin, being free, attracts the negative in the under tin. By touching it the positive flows off to the ground, leaving the under tin charged with negative and the upper



with positive electricity. By repeating this operation the charge is increased each time. As the paper does not lose its electricity, it may be used several times in succession, until the apparatus is fully charged.

A very pretty effect may be produced by pasting narrow strips of tinfoil on a pane of glass, as in the figure, and cutting across them so as to make the breaks in the form of letters or words. By connecting one end with the ground, and the other end with the electrophorus, by means of wires or chains, a spark will be produced at each break, thus forming the word in letters of light. To get good results from these experiments everything should be warm and dry. KENNETH HARTLEY.

A Home-Made Printing-Press.

BY ONE OF OUR "SUBS."

NEARLY two years ago I made a small printing-press from which I have had good service. The following is a description. A smaller one can be made by observing the proportions.

From the grocery-store I obtained two lemon boxes, having at each end and in the middle a thick piece of board, which were of hard, fine-grained wood. The boards I chose were well-seasoned and without knot or crack, and I planed them down smooth and true to $\frac{5}{8}$ in. thick $\times$ $8\frac{1}{2}$ long $\times$ $6\frac{5}{8}$ wide. I have two chases made of strips of this same wood. One is 6×4; the other $3\frac{1}{2}\times2\frac{1}{2}$. The strips are cut the desired length, $\frac{1}{2}$ in. deep $\times$ $\frac{1}{4}$ thick. The

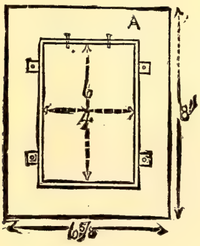


Fig. 1.

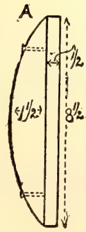


Fig. 2.

ends are dove-tailed, and, where practicable, put all around some brass to give strength. At the top insert two screws, to hold the type in place.

Now take one of the smooth boards (A), in the middle of which you screw on the chase by means of four small plates of brass, two on either side of chase, as in Fig. 1. At the back of this board (A) screw a piece of wood the same length and thickness as the board, and $1\frac{1}{2}$ in. wide at middle, as at Fig. 2.

Through the middle of this piece runs a round steel or iron pin $\frac{1}{8}$ diameter.

Make two uprights, 11 in. high, $\frac{5}{8}$ thick, $6\frac{1}{2}$ wide at base, 5 wide at top, shaped like Fig. 3. Put these uprights in a grooved board 19 in. long, $8\frac{1}{2}$ wide, 1 thick. Place uprights two inches apart (inside measurement) in the grooves, which are to be $\frac{1}{2}$ in. in depth, and so that the uprights will fit in them tightly, and screw them underneath the base board. Between the uprights, in the middle, put a piece of wood to keep them in position. This done, adjust the board (A) in such a way that the middle will rest on the top of the

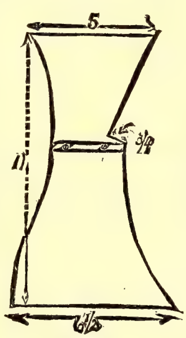


Fig. 3.

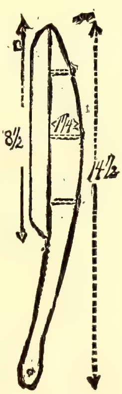


Fig. 4.

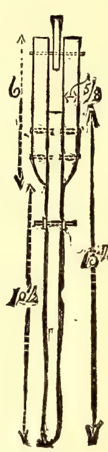


Fig. 5.

uprights, by means of the pin running through the piece of wood at the back. Hold the ends of pin in posi-

tion with staples, so that it will be as on hinges.

Now, with the other smooth board *(c)*, Fig. 4, adjust a similar piece of wood as on A, but wider in the middle, about $1\frac{3}{4}$ in. Make two pieces $14\frac{1}{2}$ long, $\frac{3}{4}$ thick, and $1\frac{1}{2}$ at widest part, Fig. 4. They are screwed

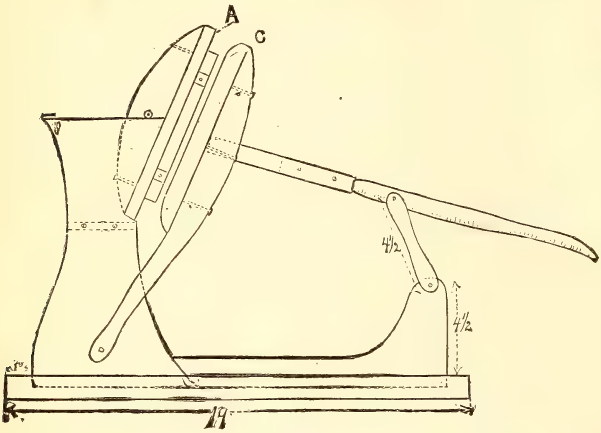


Fig. 6.

one on each side of the board, $\frac{1}{2}$ in. from edge, the top even with top of board.

Through the middle piece of board *(c)* a handle is adjusted. It is $16\frac{1}{2}$ long, $\frac{5}{8}$ thick, $1\frac{1}{2}$ wide. It fits the middle piece, and is held there by another steel pin running through handle and board.

The end of handle is held up by two pieces about $4\frac{1}{2}$ long, $\frac{5}{8}$ thick, 1 wide, one on each side of handle, and held there by a steel pin running through. Below, these pieces are held by a pin through them and through the two pieces of board which are above the base-board $4\frac{1}{2}$ in. All these joints must work easily. Fig. 6 represents a side view of press completed.

The adjustments depend not so much on the measurements as on the slope in the uprights. It is well to put the type in the chase first, and when board *c* is brought towards them, see whether they touch it equally and all over; if not, either make your slant slope more or less; and your long pieces on *c* advance more or less, as the case may be.

To put my type in the press, I turn up the chase and board (A) and insert type. To prevent this board from falling backwards, I screwed a small piece of wood across the top. On this the chase-board (A) rests, and a small hook prevents it from falling in its place.

C, Fig. 6, should be well padded with thick blotting-paper, as this makes a soft cushion for the type to press against. Paper and cards to be printed are held in various ways, pins, cord, elastic, etc. The figures are all drawn by a scale of $\frac{1}{8} = 1$ inch, and will make the explanations more clear.

Do not keep your press in too warm a place, nor wet it, as the wood may warp. Type, rollers, etc., may be had of the Young America Press Company, No. 19 Murray Street, New York City. A good surface to spread ink on can be made of a piece of sheet iron or zinc nailed to a board.

Something About Saws.—II.

BY "OUR NED."

HAND-SAWS for crosscutting require a great deal more skill to put and keep in order than the ordinary rip-saw; the latter, if intended for cutting soft wood, has all its teeth filed at right angles with the line of points, or, in other words, it is filed square across, the file being held in a horizontal or level position.

Fig. 1 shows a fair-sized rip-saw, the blade being about twenty-six inches long,

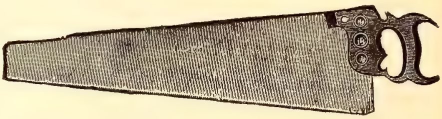


Fig. 1.

which is quite long enough for an amateur to use. A saw of this size should

have about three teeth to the inch. There should not be more than this number, but there may be less, as two and a half teeth to the inch will give very fair satisfaction, but it requires more force to drive a saw this coarse through the wood than if the teeth were finer.

The blade of a rip-saw should be a little stiffer than that of a crosscut, and should be perfectly straight, and ground thinner on the back than on the cutting edge; this will admit of the saw having less set than would otherwise be required. The shape of the teeth should be about as shown at Fig. 2. It will be noticed that the teeth are *underfiled*, or that the cutting face forms an acute angle with the line of teeth. If the cutting face of the teeth form right angles with the cutting edge the saw will not work free and with ease, as the teeth will not cut the wood, but rather pound out the sawdust. Each tooth should act on the end grain of the

Fig. 2.

wood, as a narrow chisel would; and to do this it is quite necessary that the teeth should be underfiled, or made hooked, as shown in the figure, but care must be taken not to give too much hook, for in that case the teeth would be made weaker at the base, and would be apt to break off under the operation of setting, or if the saw should run foul of a hard knot while in use, the same result might follow.

While it is necessary to warn the filer against making the teeth too much hooked, it is just as necessary to inform him that a limited amount of hook is required to give clearance to the sawdust. If the throats or gullets of the teeth are too small—which would be the case if the teeth were not filed under a little—the sawdust would fill up the spaces between the teeth, if the stuff being cut was more than a couple of inches thick, and therefore impede the progress of the saw, causing a loss of time and labor.

For amateur use the teeth shown at Fig. 2 are probably the best in shape, if for soft wood only. If, however, the saw is intended to cut hard wood, the teeth might have a trifle less hook and be filed a little beveling on the face, being careful not to file the back of the teeth beveling. Saws intended for ripping hard wood only may have more teeth to the inch than those intended for cutting soft wood. From four to five teeth to the inch will answer very well for amateur use on hard wood, though this is somewhat finer than the expert workman uses for the same purpose. The fewer the teeth in a saw within certain limits the faster it will cut, but as a matter of course will require more force to drive it through the material, and the work will not be so smoothly done as if performed with a saw having more teeth.

In using a rip-saw, the amount of work done in a given time depends somewhat on the angle at which the saw is held while in use. The position and inclination of the tool, as shown at Fig. 3, is the most convenient and at the same time the most efficient inclination for the saw to

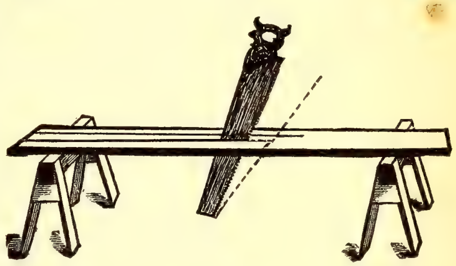


Fig. 3.

be held. If tipped over until the line of teeth is parallel with the dotted lines, it will scarcely cut at all, owing to the fact that the throats would be choked with the shavings scraped off the wood by the points of the teeth. If held perpendicular, the points of the teeth will strike the fibres square across their ends, which will make it severe on both saw and sawyer.

The clamps used for holding a crosscut saw while being filed will answer for the

rip-saw just as well. In some instances, where the amateur can afford it, it may be advisable to procure some one of the many metal saw-clamps that may be obtained for one dollar and upwards. Some of these devices are very handy, and may be attached to a bench or work-table on short notice. They are made to grip the saw-blade firmly for at least one-third the length of the blade. I would prefer, however, that the amateur make his own clamps, and use them until he becomes pretty well up in using tools, when, if he thinks fit, he may procure one of the iron clamps.

As I have before stated, a rip-saw intended for cutting hard wood should have its teeth filed a little beveling on the face edge, similar to the teeth shown in Fig. 4,

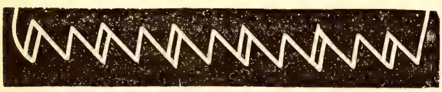


Fig. 4.

but with less bevel than there shown. There are also more teeth shown to the inch in the engraving than should be in the rip-saw.

A saw filed like that shown at Fig. 4 will rip hard wood pretty well, but it is more suitable for a saw intended for cutting soft wood in all directions, such as a bow-saw, a compass saw, or a key-hole saw, of which I will tell you more anon.

In choosing a file for sharpening a rip-saw, get one about six inches long from point to point. I always prefer a stub-pointed file for a rip-saw, and of course, I need hardly tell you that the file must be three-sided and parallel in this case. A taper three-sided file does very well for a crosscut saw, but I prefer in all cases a stub-ended file. When selecting a file, hold it to the light in a horizontal position, with the point toward you. The teeth of the file will now have their points facing you, and you can easily detect any flaw or imperfection, and if the teeth are irregular or uneven, or the color not uniform, do not take it. A file with a mottled or spotted appearance has not received an even temper. If, however, it presents a clean greyish color, even and regular, it denotes that the file is well and evenly tempered, and will no doubt give good satisfaction.

Indian Clubs, and the Way to Use Them.—II.

BY JAMES C. SQUIRES.

(Continued from page 8.)

FOR the second exercise (Fig 4), commence as before, and when both clubs are raised above the head, *reverse* the direction of the left one, and instead of describing the circle from right to left, swing it from left to right, the right club at the same time continuing its original course. A glance at Fig. 4 will show the exercise; the

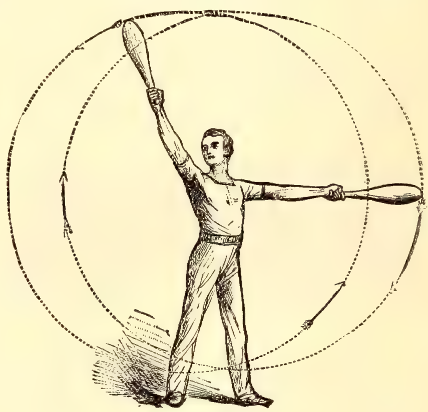


Fig. 4.

dotted lines and arrows indicate the direction in which each club travels. In this exercise (and in many others to follow) the clubs cross twice in each circle; care must therefore be taken not to allow them to come into collision (which catastrophe can be easily avoided by following the directions recently given—viz., to keep the base of each club in a straight line with each shoulder).

Exercise 3 (Fig. 5.)—This is the same as No. 2, with an additional movement—viz., that when each club is raised in its turn above the head to its highest point, the circle is checked and the club dropped behind the head, and made to describe a smaller circle in the rear of the shoulder, after completing which the larger circle

is resumed. The dotted line in the illustration shows the course of the *left* club

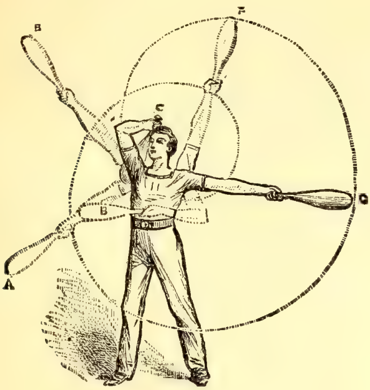


Fig. 5.

only, but the right club does the same thing in the opposite direction.

Exercise 4 (Fig. 6).—Commence with Exercise 1, and when the clubs are raised above the head allow them to drop and

Fig. 6.

make them describe a small circle behind the shoulders, then resume the larger circle on front of the body.

Exercise 5 (Fig. 7).—This is the first of the wrist "twists," and is a movement that will tax the power of the forearm rather severely. Start from the position shown in Fig. 2, and describe a circle with each club *from the wrist* in the direction shown by the dotted lines and arrows. In practicing this exercise, you will experience a tendency to drop the arms with the clubs, but you must endeavor to keep them in the position shown, *making each wrist the centre of each circle.*

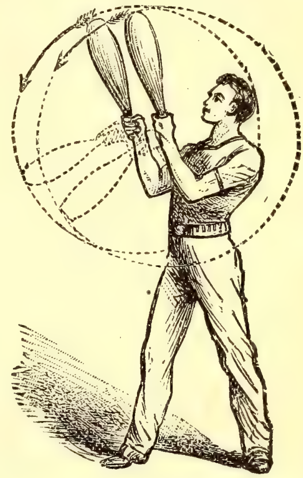


Fig. 7.

Exercise 6 (Fig. 8).—Now for a twist in which each club describes a circle in an opposite direction. Again be careful to

Fig. 8.

avoid a collision, and keep the wrists level and opposite each other.

Exercise 7 (Fig. 9).—This is rather difficult, but with a little perseverance you

will be able to accomplish the movement, and as it is very pretty it is well worth

Fig. 9.

the trouble. Carefully study the illustration, and follow the course of the dotted lines (which show the direction of the right club only; the left club takes a corresponding course in the opposite direction). Keep the hand close up to the chest, almost touching it in fact. You will observe that the club describes a *small* circle from the centre of the chest, and is then swung completely round at arm's length to make the *great* circle.

Something About Pets.

DOGS and other animals are very variously affected by musical sounds; some manifesting dislike, others enjoyment when within hearing of music. "I knew," writes a correspondent, "one dog that, when requested to sing, would stand on his hind legs and go on whining and howling for almost any length of time, and while the performance was attended to he manifested great enthusiasm. But he also enjoyed real music very much, and showed signs of pleasure when the piano was played, getting as near to it as possible. Occasionally, however, he would *take a part* without being invited, much to the discomforture of a singer, who would wonder where the extraordinary accompaniment came from. I have a lively recollection of his volunteering assistance when we were singing a hymn one Sunday evening, and of the way in which it was brought to an abrupt conclusion, by the sight of our doggie on his hind legs, and the sound of his whines ringing out above every human voice."

A pug dog, a great pet, has a favorite tune which he distinguishes from all others. Nugget is a musical animal, and has a way of putting in occasional notes of his own when his mistress plays the piano. But when she commences *his* tune, Nugget becomes greatly excited. He first capers up and down the room, and then, running to the side of the player, he stands on his hind legs and accompanies the music in a style peculiar to himself and most amusing in its effect on the listeners.

Nugget's mistress or any other performer may play the piano by the hour, and the dog manifests only an ordinary amount of interest. But no matter how suddenly *his tune* may be introduced, Nugget shows his appreciation of it by going though the performance already described.

The lady attributes the dog's fondness for the tune to the fact that when he was a puppy her little niece used to play it upon the piano, singing only the word "Nugget" again and again to the music. As, however, the pug recognizes the tune itself, when simply played, from all others, it is quite evident that he has a musical ear, and is not in any way guided by words.

The question is often asked, "Do dogs understand what is said?" and to this everyone will reply, "To a certain extent they do, as is shown by their obedience to their master's commands."

"He can do everything but talk," is a not uncommon remark of a dog-lover, as he pats the shaggy head of his four-footed friend and companion.

Still no one will assert that dogs understand an ordinary conversation, though they undoubtedly often listen attentively when they are fond of the speakers, and obtain bits of information from detached words.

More than this, they obey signs in a stealthy fashion, and move as if they were

treading on eggs, thus showing that they look upon a signal as an injunction to secrecy, and act accordingly.

In proof of this the following is told of the doings of an English terrier.

"Brisk has been unfortunate enough to offend her master. Being in want of something to do she gnawed the leg of a handsome chair, and was chased out of the dinning-room in consequence.

Having been accustomed to spend a good deal of her time on the hearthrug, she objects to this banishment, and as she is tolerated there when the master is absent, she is always on the look out for his departure in the morning.

She will peep in at the dining-room door and look at her mistress, as if to ask, "Is he gone yet?"

Without speaking, the lady will lift up her husband's hat or umbrella, or point to the outdoor boots by the fire-place; when Brisk slinks off again, knowing that if these articles are in sight, the master has not taken his departure yet. As soon as the hall-door closes, Brisk prances in, tail erect, and manifesting her delight in every possible way, she takes up her favorite position.

But, let her mistress rise and place her husband's slippers on the hearth, Brisk requires no other notice. The dog, so to speak, "has had her day," and she at once retires, knowing that the slipper-warming process always precedes, only a few minutes, the arrival of her master.

If the lady when conversing with a friend, introduces the words, "William (William is her husband's name), will soon be home," or, "I believe William is coming," Brisk immediately rises, walks to the door, and manifests great discomfort until it is opened and she can get out of the room.

Yet the lady merely introduces a remark about her husband's return in the course of conversation, and without looking towards the dog or varying her tone. Brisk may be stretched apparently asleep, but she never requires a second warning.

Again, if the lady makes any allusion to her intention of going out when in the dog's presence, Brisk follows her everywhere, dogging her footsteps and never losing sight of her for a moment, lest she should be left behind. But let her mistress say, "I shall take a bus or car," and Brisk gives it up as a bad job and retires to her own quarters sulky and digusted at being disappointed of her anticipated run.

Visitors to Brisk's mistress are often amused by seeing the effect produced on the little animal by these apparently casual allusions, and are convinced that this dog not only pays attention to the conversation, but understands certain portions of it in which she is indirectly concerned, though of the greater part she can comprehend nothing.

There is a very popular belief that some of the movements made by cats are influenced to some extent by "coming events" in the atmospheric world. Good weather, it is said, may generally be expected when cats wash themselves, and the reverse when she licks herself against the grain of her coat, or washes her face over her ear, or sits with her tail towards the fire.

In Germany if it rains when women have a large washing on hand, they say it is a sure sign of the cats having a spite against them, because they have not treated the animals as they ought to have done. This belief is rather a favorable one for the cats, and often, among the working classes, insures for them, better treatment than they might otherwise get.

An enemy to cats may depend upon being carried to her grave during a storm of wind and rain or freezing snow; and in Holland, if the weather is rainy on a wedding day, the saying is, that the bride has neglected to feed the cat. English sailors do not much like to see cats on board ship, least of all do they care to see them unusally frisky or playful, for then they say, "the cat has a gale of wind in her tail." A strange black cat making her appearance in the house is said to be a sure indication of heavy rains and floods. It appears that these cat indications and omens, have no effect unless a she cat is the chief actor. Tommy, it would seem,

is not at all affected by the coming changes in the weather, neither does it appear that pussy has any ill feeling against the sterner sex; for their spites and evil prognostications seem directed more particularly against the gentler half of humanity.

That cats are musical we all know, and though we may not appreciate their renderings, we are frequently forced to acknowledge the strength of their vocal powers. However cats may like their own renderings, it is a recognized fact, that, with but few exceptions, they do not like the musical renderings of human beings; in fact, music and harmony, seem to be sources of great annoyance to them. A writer on this subject, tells the following story which goes to prove that the cat mentioned was not only pained by hearing the music, but that also, she had intelligence enough to make her feelings on the subject known:

"A black cat belonging to a friend, in whose house I was a guest some years ago, had a strong dislike to music in every shape, but especially to singing. Having noticed this peculiarity, I am afraid I teased poor pussy a good deal by my endeavors to produce a manifestation of her feelings with regard to vocal music, and when she was stretched comfortably by the fire I used to begin to sing, taking care to shut the door first. Puss would jump up, rush to it, and finding the means of egress cut off, would run wildly round the room as if in distress until I ceased. Not to irritate the creature too much, I generally made my vocal performance a very short one.

On an exceptional occasion I thought I would try the cat's powers of endurance a little longer, and went on singing, when, after vainly trying to escape, the creature sprang at me, placed one paw across my mouth, and clung to my dress and neck with the rest of her claws in such a fashion that I was only too glad to cease my song and so pacify the desperate animal.

When pussy's claws were disengaged I was not a little relieved, and I need hardly say that this was the last time I ventured to experiment on the cat's patience. My friend was also much alarmed, and I have no doubt thought, as I too did, that I had escaped almost better than I deserved, under the circumstances, for I had only a few scratches.

Winter Rambles.

BY A. W. ROBERTS.

BEFORE I was fifteen years old I took my first lesson in skating. Oh! what a bitter day it was, so cold that I was the only boy on the pond.* I stood it for an hour, and as none of my schoolmates came to bear me company, and my feet had become very numb with the intense cold, I determined to take off my skates and go home. So, sitting down near a clump of elders, I was soon hard at work tugging away at the frozen straps, through which numerous wooden wedges had been driven for the purpose of tightening them up, for it must be known that the boys of those days did not have as much pocket-money as those of the present time—in fact, one pair of skates had to do duty for an entire family, and I was wearing, or trying to wear, my big brother's old-fashioned "turn-ups." The beautiful strapless American skate of the present time was not known then.

"Oh! bother these big, clumsy old skates, with heel straps, toe straps, and instep straps. Will I ever get them off before I am frozen stiff? If I could only find a stick and a stone, I'd drive those wedges out mighty quick!" I exclaimed. Turning to the clump of elders, I broke off a stick, after which I began searching in the dry grass for a stone. By this time my limbs were aching so severely with the intense cold that it was all that I could do to keep back the tears; yet, strange to relate, in the midst of all my pain and trouble I captured my first and most beautiful of all the fairies of the woods, hedges, and meadows, who was wrapped up in hundreds of yards of beautiful soft silk, into which and

* At the time referred to, this pond occupied the exact spot where is now situated the Union skating-pond of Brooklyn, E.D., in a large tract of woodland known as "Johnson's Woods."

through which were woven brown leaves of grass and daisy stalks, the whole being securely fastened to a thorny blackberry cane, that fairly bristled with savage and vicious-looking thorns, as if to afford her protection from harm. Of course I was too inexperienced to know how beautiful, exquisite, and wonderful a creature was enclosed within the warm and waterproof wrappings of silk, but sure I was that I had become the possessor of one of the secrets of the wonderland of the woods, the fairyland of Nature. In an instant my aching limbs were forgotten, quickly were my feet released from the skates, and, on my hands and knees, I was closely examining the elderberry and blackberry bushes for more of these strange objects. My search was not in vain, for when I returned home I carried with me nine of these mysterious creations.

After supper my strange "finds" of the day were spread out on the table, and the entire family were called to inspect them and decide what they might be. One thought they were the nests of some variety of giant spider, another that they might be the winter quarters of bats, or that they were the nests of hornets or some other equally undesirable insect. My big brother, who was studying surgery, suggested the propriety of dissecting one of them, and by this means find out what sort of an animal lived within. "What! cut one of them into pieces and destroy it? Kill it just out of idle curiosity? No, indeed!" I exclaimed, at the same time gathering them up hastily, fearing he might be tempted to put his suggestion into execution. One point they were all agreed on, viz., that I had better keep them in the hay-loft of the barn, and under no consideration in my bedroom. Now, you must know that I had not the slightest intention of hanging them up all winter in the cold hay-loft, for be it known I had kept in my bedroom for many weeks a box that contained a live garter-snake, with her ten baby garters; little beauties they were, too, ranging from three to four inches in length. Gracious! how they could eat grasshoppers and May beetles! Now, if Nora, our servant-girl, had known of this, it would be the last time she would enter my room, and I would be ordered to make up my own bed and take care of my room for all future time to come. In this room was a large closet, of the top compartment of which I was supposed to be the entire owner and occupier, it being so high up that no one cared to claim it. Secretly I determined that in this closet these silken mysteries should be kept. So here all winter long they were watched over and guarded with jealous care, but instead of nine of them, I had increased the number to twenty-four, having made several journeys to the woods in quest of them. The winter months had passed away, and the season of bursting buds and the return of Nature's sweet-voiced musicians had come; bunches of wild flowers stood on my window-sill. Going to bed early was no longer the order of the day. So it came to pass that on one moonlight night, after having retired, I remained awake for a time, planning out my Saturday's wood-ramble. Happening to cast my eyes towards the window, through which the moonlight was flooding the room, I was astonished at beholding what seemed to be hundreds of bats flying outside of the window. Was I frightened? Oh, no. I got up, determined to investigate and solve this curious phenomenon. Well, inside of the room were what appeared to be some ten or twelve bats endeavoring to make their escape out of the room through the window, and outside were some twenty or thirty of the same creatures dashing against the window-panes, as if determined to gain an entrance and rescue their imprisoned friends.

Exactly what to do I did not know. I was afraid to raise the sash, fearing that those inside would join their friends outside, and so I would lose all of them. With a scap-net, which fortunately I had hanging in my room, I captured one of the flying objects, which proved to be a variety of the largest and most beautifully-colored and marked of all butterflies that I had ever read of or expected

to possess. Long and silently I watched them as they constantly charged and dashed against the glass of the windows. Evidently they could see one another through the glass, or were possessed of some other means of communication.

It took me some time and much trouble to capture and confine in my closet the flying beauties that were in my room, after which I boldly lowered the upper sash of the window, when in flew all those that were outside. Quickly closing the window, they were safely imprisoned. Fearing that those confined in the closet might injure themselves, I released them. Well, it was a beautiful sight, this bedroom full of butterflies. I sat on my bed and watched them circle and float about in graceful curves, and when they passed through the bright moonlight, it was assuredly a fairy scene from the fairyland of Nature. For an hour I remained perfectly quiet, so absorbed was I in wonderment as to how this curious event had come to pass. At last I was aroused from my reverie by becoming conscious that the atmosphere of the room was being charged with a very peculiar and penetrating odor; it was not absolutely disagreeable, but was certainly very oppressive, and it seemed to me that as the mysterious odor increased, the butterflies seemed to divide into couples as they continued their merry moonlight dance. At last the odor becoming so oppressive, I remarked to myself, "A. W. R., don't it strike you this atmosphere is becoming a little too tropical? Hadn't you better lock your door on the inside, get out of the window, slide down the kitchen roof to the garden, and take a sleep with the cows to-night? Mark you, it will never do to go down the stairs, for there's two that squeak dreadfully when trod upon after ten o'clock at night." This being the true state of affairs, I turned to the window from out of which I intended to make my exit, and was astonished at beholding almost as many butterflies fluttering about the outside of the window as was contained in the first congregation that I let into the room only an hour before. "Oh! come in, come right in; don't be bashful, odorous fairies of the moonlight! Take full possession of my bedroom, and have a good time!" I exclaimed, at the same time pulling down the upper sash and letting them in. Then raising the lower sash, out I went. Early in the morning I was up and in my room again; not a soul knew or suspected that I had been "out all night." My room was a sight to behold! On the walls, on the bed-clothes, on bunches of autumn leaves, on rustic-work, were plastered strings and masses of small eggs of a dull yellow color, and in every direction hung the butterflies, listlessly, as if tired or weary, hardly moving a wing. Poor things! if they had not been confined in this room, but had had their freedom, they would have deposited these thousands of eggs on the young and tender leaves of the elder. When I took mother, father and brother to my room to see this wonderful assemblage, and related my adventure of the previous night, they could hardly credit it. I asked them what was best to be done with so many beautiful butterflies. They were unable to advise me, till my brother happened to remember a doctor and druggist who lived near by, and who was quite a naturalist, and suggested that I take a specimen to him and ask his advice on the subject. The result of this interview I will give in the next issue of the Young Scientist.

Casting in Plaster of Paris.

BY MARK MALLETT.

I. *The Material and its Preparation.—The Moulds and How to Make Them.*

SOME knowledge of the art of casting in plaster is essential to those who model, since without it they have no means of giving permanence to their work. There are also other purposes for which it may be both useful and interesting; for casts may be made from various objects, natural or otherwise, and applied, as I propose to show, to practical and decorative ends.

Plaster, commonly termed "plaster of Paris," from having in the first instance been brought to this country from the quarries and works of Montmartre, near that capital, is made from alabaster or gypsum. This mineral, more scientifically known as sulphate of lime, consists

of sulphuric acid, pure lime, and water, in the proportions of 46 of the first, 32 of the second, and 22 of the third.

That quality which renders plaster so valuable in the arts, is its power of setting into a solid body after being simply mixed with water. This, whilst the plaster is fresh from the kiln, it does in a few minutes; but with time and exposure to the air, it gradually loses this power. It sets less and less quickly, and when quite stale refuses to set altogether. Thus, bad plaster may involve total failure and disappointment, to guard against which it is well to buy of a dealer on whose word you can rely.

If you feel any doubt with regard to your plaster, try a little before you begin your work, and prove whether it sets properly or not. If you find it necessary to keep plaster for any length of time, put it in a dry place, and exclude the air from it as much as possible. I have kept superfine perfectly good for three or four years by shutting it in a closely-fitting tin, and then well wrapping it in paper. Fresh plaster is always to be desired; yet if very fresh, one difficulty attends it: it may set so quickly as scarcely to give you the necessary time to use it after you have mixed it. If so, you must bestir yourself accordingly.

There are various methods of making moulds for plaster casting. When a clay model has to be dealt with, the process called *waste moulding* is employed, because the mold is destroyed in the production of a single cast. This method I shall first describe.

Waste Moulding in Plaster.—Let us suppose that the amateur has made a model, such as a panel charged with rosettes or foliage. This will have been modelled on a board somewhat longer and wider than itself, the model being, say, a foot square and perhaps from two to three inches thick. Plaster of a medium quality will do for this work; and be sure and have enough of it. If the supply fails whilst the work is on hand, the moulder will be in an awkward position.

And here let me premise, that though plaster is among the most cleanly of substances, odorless in itself, and a neutralizer of all things that have bad smells, it has a tendency to get splashed about and trampled upon floors, in such a way as to make a mess, and to rouse the temper of good housewives; for which reason it is well to practice casting in some workshop or back-kitchen, rather than in an ordinary living room.

Having laid the model flat on a table, its surface must be damped. Sculptors use a syringe, pierced with minute holes, for throwing water in the form of fine spray over their models. Such an instrument the amateur will not possess; but he will have what, for small models, does still better—his mouth. Fill your mouth with water, and after two or three trials, you will find that you will be able to blow it out in a cloud of fine spray. Blow a mouthful of water in this way over your model. Nothing else will so well prepare it for the reception of the plaster mould. In no other way can you damp the whole surface so regularly, without over-damping it, and causing water to run and stand in deep cuttings and hollows, where, mixing with the plaster which is to form the mould, it would tend to soften and injure it.

For reasons which will appear by and by, it is desirable that the first or inner mould should be tinged with color. Various coloring matters are used, according to the whim or practice of the moulder. Many use yellow ochre; but this and similar pigments have a tendency to soften the plaster, which is objectionable. Nothing is really better than common ink, the tendency of which is rather to harden the mould than otherwise, and of this less will suffice than of anything lighter in hue.

Before you begin to mix plaster, it is advisable to tinge as much water as you will want for your inner mould—say a quart in the present instance. Remember that it is merely to be tinged—that it is to have so much color only as will enable you to distinguish readily the plaster mixed with it from that mixed with plain water. If you put more color than this, you will run the risk of staining and disfiguring the cast itself.

We are now ready for mixing the plaster. Two-thirds fill a basin with the colored water, and then begin to sprinkle in the plaster. Do this with the hand, that you may detect any lumps that it may contain; and should you meet with any lumps that do not crumble readily, throw them aside. As you sprinkle the plaster over the surface of the water, it will gradually become saturated and sink. This method of mixing is superior to any other, because the air contained in the plaster is thus driven out, and not imprisoned, and so does not form bubbles, which would injure your work. Go on sprinkling till you see that the plaster no longer sinks, but stands up in hills above the water; this is a proof that enough has been put in. The water takes the proper quantity, and no more.

The mixture must now be well beaten up with a spoon. For mixing superfine, and even fine, if the work is particular, use a silver spoon, as baser metal, particularly iron, may discolor the plaster. Beat quickly but carefully. Beware lest in doing this you beat air into the plaster, and so cause bubbles. There is a way of beating by which the spoon is kept at the

bottom of the basin, and by a quick motion, without bringing its bowl to the surface, the plaster is made to boil up. This is the proper motion to use. As soon as the mixture is of an even consistency, skim off the impurities and those bubbles which in spite of all your care will have formed, and throw them away. When mixed, the plaster will be of the consistency of thick cream. All these operations, which take some time to describe, must be done quickly. No moment must be lost whilst mixing the plaster, or you will have it set before you are ready to use it.

Now, with the spoon, throw the plaster all over the face of the model. See that it goes well into every nook and cranny, or you will have an imperfect mould. Beneath undercuttings you can dash plaster from the spoon. Have a pair of bellows at hand, and with them, by blowing the liquid plaster, you can force it in, and the air out of, the hollows. See that every hair's-breadth of the clay is covered. But whilst you are busy doing this, beware that you do not with spoon, hand, or otherwise touch the surface of the soft clay, or mischief will ensue.

Mix more colored plaster, if necessary, and go on till you have laid a coating a quarter of an inch thick over every part of the model; but do not trouble to leave an even surface: it is better that there should be some lumps and irregularities, which will serve to hold this inner mould to the outer one.

The inner mould is now made, and in making it you will have had to bestir yourself. You may now take breath, and pause for five minutes, at the end of which time you will probably find your mould firm enough for the next process. Mix some modelling clay and water as thick as cream, and with a small brush (a painter's tool) go over the mould. The object of this is to cause the outer and inner moulds to separate readily when required to do so.

The outer mould we have now to make. For this purpose coarse plaster is sufficient. Now and for future operations you will use not colored but plain water. But because you are using coarse plaster, do not mix it carelessly. It is of much importance that plaster should always be properly mixed; and after each mixing it is well to cleanse out the basin, and especially when on the more particular parts of the work, with fine plaster. With coarse plaster it is not necessary to be quite so particular.

A layer of coarse plaster having been thrown or poured all over the mould, and allowed slightly to harden, irons will have to be laid on to strengthen it. As plaster sets and dries it tends to warp, hence the necessity for thus strengthening the mould. Persons who are frequently in the practice of making waste moulds, such as sculptors, keep by them a quantity of thin iron bars of different lengths, and bent in different ways, to use as occasion may require. But any pieces or instruments of iron of suitable size that may first come to hand will do. When I was a student at South Kensington, twenty years ago, instead of the present stately buildings, the Art Schools were mere temporary sheds attached to an old suburban residence, and the kitchen of the former mansion formed our casting room. Whenever a bas-relief was cast, it was noticed that the poker and tongs invariably disappeared—had the gridiron and ladle of the old kitchen still hung in their places they would inevitably have gone into the mould also! In short, any pieces of iron which will stretch from side to side of the mould and prevent warping will suffice. More plaster will have to be poured on in order to imbed them, and the outer mould should thus be brought to a general thickness of not less than three-quarters of an inch.

After an interval of about half an hour the mould will be found to have thoroughly set, and we may now begin to separate it from the model. Where the plaster touches upon the board round the outsides, there will be no adhesion between it and the wood, and the slightest effort will open a chink between them. Into this chink water must be poured, and the mould gently worked up and down with the hand. This will cause the water gradually to work its way between plaster and clay, softening the latter, and if the model is not in very high relief, and there are no considerable undercuttings, with a little patience and frequent pourings in of water, the mould will presently come off. Still it will probably bring some projecting pieces of clay with it, which should be picked out with some of the wooden modelling tools, not with any iron instrument, for fear of injuring the mould. But if the ornament should be in high relief, and the undercuttings should be considerable, this plan will not answer. Instead of it, a string or wire should be passed into the before-mentioned chink, between wood and plaster, and with it the model, mould and all, cut from the board. The string will cut through the soft clay with little difficulty. The mould can now be laid on its back, and the clay dug and pulled out of it, wooden tools and fingers being best to use. Whilst doing this a little water should often be poured between clay and plaster, as it will much expedite their separation.

The clay being by one means or the other removed, the mould must be thoroughly washed with soap and water. A

sponge and a soft brush must be used—not a hard brush, which would scratch the mould. Every trace of the clay must be removed. It is better to clean and fill the mould at once; but if for any reason it should be necessary to lay it by for a day or two, or for a still longer period, during which it will have dried more or less, it must be thoroughly soaked before the plaster is poured in. Otherwise, cast and mould will adhere so closely together that it will be difficult to get the latter off. When the mould is freshly made there will be no danger of this. To hardened plaster, partially saturated with water, liquid plaster adheres firmly; to that which is dry, less firmly; to that which is completely saturated, it sticks so slightly as to be easily separated.

(To be continued.)

Our Girl's Department.

This department is intended exclusively for "Our Girls," and we hope to make it both interesting and instructive, and to this end we ask our young lady readers to assist by contributions, suggestions, or illustrations. There are thousands of little things that can be, and have been, made and done by young ladies, pertaining to decorative art, needle-work, etc., etc., that would be gladly followed but for a want of knowledge on the subject, and we know of no more pleasing task for a lady than that of teaching her younger sisters that which they are anxious to learn, and which may prove of real benefit to them in the future, as well as being useful and interesting for the present. We trust we will have no difficulty in persuading those who have something nice to show or speak of, to make use of this department. Remember, it is open to all, and if you have anything worth knowing suitable for this column, send it along, and we will give it our best attention. Do not be afraid to write because you may fancy your composition is not perfect, or have other scruples of a similar kind. Do the best you can, and leave the rest to the editor of this department, and we are sure you will be pleased with your work.

PRAISE not people to their faces to the end that they may pay thee in the same coin. This is so thin a cobweb that it may with little difficulty be seen through; 'tis rarely strong enough to catch flies of any considerable magnitude.—*Fuller.*

—A wise woman reflects before she speaks; a foolish one speaks, and then reflects on what she has uttered.

—It is a curious fact that children are the best judges of character at first sight in the world. There is a Scotch proverb, "They are never cannie that dogs and bairns dinna like," and there is not a more true one in the whole collection.

—We are ruined not by what we really want, but by what we think we do; therefore, never go abroad in search of your wants; if they be real wants they will come home in search of you, for she who buys what she does not want will soon want what she cannot buy.—*Colton.*

—The broad, low dressing-table with tiled top and swinging glass is now the desideratum in every lady's boudoir.

—The latest menu cards represent lily leaves or flowers, without a margin, and have the name inscribed in gilt letters.

—The ugly carpet ottomans have been superseded by the old-fashioned foot-stools, with square frames and embroidered cover.

—Table glass has become almost infinitely diversified in form and color, but the rose pink and pale yellow are preferred for decorative effects.

—Fashionable window shades are of cream-colored linen, with a bordering of drawn work, and are finished off by knotted fringe cord and tassels.

—A beautiful ornament for the centre table is a large crystal ball mounted upon a small spiral pedestal. It catches and reflects the light, and forms a wonderful radiator.

—Nobody buys white crockery now-a-days or the white China with the dreadful gilt band, which gradually wore off into the tea a few years ago. Why cannot the hotel and restaurants get rid of their "brutal" white stoneware?

—Painting on chamois leather in silver and gold is a novel style of decoration, especially suitable for handkerchief-cases, glove-boxes, or scent-satchels. The chamois cleans well and takes color beautifully.

—An umbrella and cane stand is formed with a frame work of wood, and a case attached, which is of pasteboard, covered with plush, handsomely embroidered, or with one tapered cylinder front and two small ones at the back for canes.

—The fashionable style for portieres is not to have them hung from rings from the pole, but thrown over it in such a way that one side shall turn back and fall

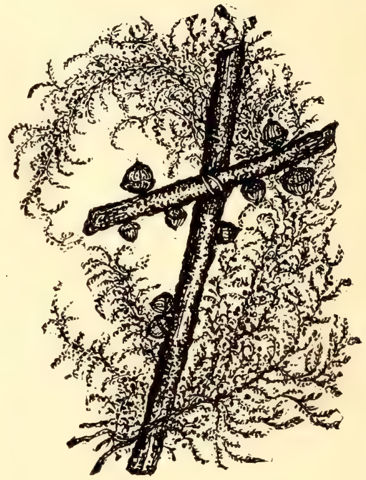
over in the shape of a valance. When well done, this fashion of hanging is graceful and effective.

— A lady now teaches the Metropolitan Museum, New York, day class in decoration for women, with the use of tempera or body-color in the artistic decoration of leather, silk, satin and glass, to which is added a course of drawing, and the use of color in preparing designs for industrial ornamentation.

— A novel decoration for the unsightly transom windows which disfigure so many rooms in city houses, is made by filling in the space with deep-colored damask paper, upon which handsome raised paper figures are laid. The figures, which are of every variety, can be bought singly for 25 cents at any of the leading wall-paper and decorators' establishments.

— Miss Ellen H., Brooklyn, sends us the following seasonable suggestions, which will doubtless be of service to many of our lady readers: "In decorating the church for Easter, arrange your flowers with regard to the effect from a distance. Choose characteristic flowers rather than those hothouse beauties which we can get all the year round. No flowers are more effective than the Easter lilies (L. candidum and longiflorum). The passion-flower comes next, and where smaller flowers can be used, hyacinths, crocuses, narcissi, primroses, violets, lilies-of-the-valley, and snowdrops supply both beauty of form and delicate coloring; the fresh pinks, lilacs, and primrose yellows of the true spring flowers are, I think, quite in place. For green, nothing is better than ferns, and for draping, English ivy and passion-vine; where *lightness* is needed, sprays of acacia will give the desired effect. Palms are good, but the list of pot-plants suitable to be used where elaborate decorations are intended is too long to enumerate here."

— As ornamental cards of all kinds are very fashionable just now, perhaps some of our young lady readers would like to make something novel and artistic in that line. The illustration shows how an ornamental card may be made by utilizing some of Nature's simple productions. Procure a neat white or gray pebble card of suitable size for a background; then take two slips or bits of twigs of any of our dwarf oaks, to which are attached a few of their small, but beautiful brown acorns. The twigs should be split down about one-half, which can readily be done



with a knife. This will leave the twigs half-round, with one side flattened, which will be the side to gum or glue to the card. Draw a cross or other suitable design, with a pencil, in very light lines. Cut the twigs to conform with the lines drawn; gum them fast to the card, being careful that the gum or glue does not spread on the paper. When fastened on and dry, surround the design with a nearly circular wreath of wood mosses or lichens, among which place here and there, as taste may suggest, a few heads of the bright crimson "sealing-wax moss" (lichen). The mosses, of course, must be fastened in place with the smallest amount of mucilage or glue possible, and they may be arranged to suit the taste of the maker. Such a combination of natural materials, when tastefully applied, exceeds in artistic beauty many of the fancy cards that are found in most of our stationers' shops; and to those who have a taste in this direction, the making of such cards is a gratifying and pleasing pastime.

THE

Young Scientist.

A Practical Journal for Amateurs.

(With which is incorporated "THE TECHNOLOGIST," "THE INDUSTRIAL MONTHLY," and "HOME ARTS.")

PUBLISHED MONTHLY AT $1.00 *PER YEAR.*

EDITORS.

FRED. T. HODGSON. JOHN PHIN.

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THE INDUSTRIAL PUBLICATION CO., 49 Maiden Lane, New York.

Will those of our subscribers who receive two copies of the YOUNG SCIENTIST, kindly hand the duplicate to some friend interested in such matters, and thus perhaps aid us in securing a new subscriber? Remember that every additional name enables us to improve the Journal, so that all have an interest in adding to the number of our subscribers.

Contributors to the YOUNG SCIENTIST will help us along very materially by sending in their communications on or before the tenth of the month preceding the date of issue, as we go to press about that time. Wherever drawings or engravings accompany the communication, they should be sent in at least ten days earlier than the time mentioned above, as it takes from ten days to two weeks to get the cuts made from the drawings. We hope our young friends will make a note of this, and send in their always welcome contributions early enough to insure their publication on time. We have found it necessary to make the foregoing remarks from the fact that several excellent communications and drawings came in for this issue, but were too late, and they are of such a character as to be of no service next month.

Although we do not place much faith in the sayings of Wendell Phillips, when giving utterance to opinions of his own or propounding theories from his inner consciousness; but when he makes an assertion, and states it as a fact, he commands our attention at once; and when he states definitely, and without qualification, that ninety-nine per cent. of the graduates of our colleges are never heard from as successful business men, and backs his assertion with apparent facts and figures, we are astounded, and wonder if some mistake has not been made. Can it be possible that this assertion is true? If it is, what becomes of this ninety-nine per cent.? Are the hundreds of M.D.'s, A.B.'s, A.M.'s, LL.D.'s, etc., that are yearly turned out by the great colleges of this country, useless appendages or worse to society? If not, where do they all go to, and what do they do? These queries are worthy of consideration, particularly so to parents who have boys approaching man's estate; for if it is true—and there are some reasons for thinking it is—that only one boy out of every hundred sent to college becomes a successful business man, fathers should hesitate before sending their boys to colleges. If parents have plenty of means, and their children are likely to inherit them, then it may be well to give the young people the highest education attainable, and this, we think, can best be done through our colleges.

We have no hesitation in saying that our technical schools and institutes offer better facilities for acquiring knowledge of a practical kind, and which will prove of greater pecuniary value to the aspiring youth, than can be obtained from a purely classical training. This is a matter of considerable import to boys who will have to make their own way in the world. We do not wish it understood that we undervalue a college training; on the contrary, we wish it were possible for every boy in the country to obtain such training, but we must say that we are of the opinion that a thorough technical training in some school where the boy is brought face to face with the stern realities of life, will be of immeasurably greater value to

him—and to the State—than all the Greek and Latin lore of bygone ages would be. Most of the useful and successful men of the present and past ages received their training outside of college walls, and under circumstances that fitted them for the active lives they were destined to pursue. A thorough scientific course with relation to the arts must naturally conduct the mind into logical grooves and prepare it to grapple successfully with the hard facts and problems that are continually developing, and the parents of a boy who bends his energies to the acquisition of mechanical and scientific knowledge, need have no fears for their boy's future. Depend upon it, the mind that has grasped the various problems and their solutions that are connected with the mechanical sciences, will not only hold its own in life's battle, but it may safely be said of it that success and prosperity will rise at its bidding.

When you have a valuable pattern for scroll-sawing, and want to keep it good for future use, a good plan to preserve it is to prick it through with a needle or other fine-pointed instrument, as close together as possible. Then lay the pattern on the wood to be sawed and pound it over with a bag filled with fine charcoal dust. Upon lifting up the pattern you will find a perfect duplicate of it on the wood. The pattern may be transferred to white paper by this method, and the lines traced with a pencil, after which the paper with the made pattern may be fastened on to the wood, and the latter will then be ready for cutting. Transferring the pattern to white paper first is much the cleaner and better way.

Another and a better way to transfer a pattern is to take a plain sheet of writing or printing-paper; lay it on a table or other flat surface. On this place a sheet of good transfer paper (black is best), and then the design; fasten with tacks or drawing pins; then, with a fine pencil or other pointed tool, trace carefully around the design, and when finished a good plain copy will be found on the white paper, and the original design unhurt. In applying this design, a good way is to use a small quantity of ordinary mucilage. After the work has been cut and completed, the design may be removed by damping it with a moist cloth or sponge, and may be used again if desired. Should the wood become damp in taking off the pattern, it should be placed between boards weighted down, to keep it from warping. When dry, it may be taken out and used for what it was intended.

Scientific and mechanical amateurs are invited to send communications to this office with regard to the various problems they may be working out. Advice and assistance will be gladly given through our columns on any scientific or mechanical subject that may be within the range of amateur experiment, providing it is of such a character as will prove instructive or interesting to the majority of our readers. It will give us great pleasure to answer any question relative to the scientific, mechanical, industrial, and decorative arts in our column of "Notes and Queries," and we trust our readers will not be afraid to make use of this department. If you have any little mechanical or scientific difficulty, let us know of it; some fellow reader will probably be glad to relieve you and render great assistance to many others, by publishing such information as could not be otherwise secured, or we might help you amazingly by offering such advice and suggestions as our large experience might warrant. While we do not wish to make the department of "Notes and Queries" general, we have no objection to the admission of questions and answers that are not strictly scientific or mechanical, but which partake of a practical and useful nature. There are many things boys and girls want to know about birds, dogs, cats, rabbits, goats, white mice, guinea pigs, gold fish, and other pets that may safely be submitted to this column. It frequently happens, too, that girls may want to know something regarding their own special class of work, such as knitting, embroidered and other fancy needlework, or they may wish to know something of the treatment of window plants, flower-gardening, and many other things of a

like nature. Any questions of this kind, when requiring answers that will be generally interesting or instructive will be cheerfully replied to, either by ourselves or correspondents.

The parents who have wisdom enough to appreciate and cultivate the mechanical interests common to most children, go a long way towards insuring their success in after life, for fingers trained to works of skill are not likely to be afterwards found idle. The development of mechanical desires and tendencies in children should be encouraged by every one who wishes them well now and hereafter. From a worldly point of view, the cutting and whittling instinct in a boy or girl represents a money value of considerable magnitude, and the parent or guardian who neglects to aid the growth and development of this valuable trait, is, to say the least of it, grossly indifferent to the welfare of his charge—he owns a diamond in the rough, that would be doubled in value by polishing and setting. All our great constructors, inventors, successful civil and mechanical engineers, mechanical superintendents of our shops, factories, shipyards, and railways, are men who early evinced a disposition to cut, whittle, saw and tinker; and the hundreds of intelligent women in this country who direct the work of the thousands of their less gifted sisters in the various millinery, dress-making, and other establishments where female labor is employed, were ladies whose early tendencies to "scissor," cut, hem, patch, and whittle often caused their parents to wish the "mechanical instinct" had never shown itself. These men, these women, one and all, owe their positions, in a great measure, to their "mechanical instincts," and here is where the money value lies. The man who, by his superior knowledge and intelligence, commands from fifty to one hundred per cent. more for his services than his neighbor, owns a property of great value, and one that is not subject to many of those mutabilities which often, without warning, sweep away the gatherings of a lifetime. Give the children tools—boys and girls—mechanical toys, books, and simple scientific instruments, and, where possible, a workroom. Let them cut and whittle to their hearts' content. Give them the benefit of your knowledge of mechanical matters as you would of any other thing that you think would be of use or interest to them. Lead their efforts on to pleasing and useful results, and you will lay the foundation of future usefulness and competency. The YOUNG SCIENTIST has special claims on parents and guardians, and if introduced to their charges in a proper spirit, will assist in developing a taste for mechanical and scientific research that will not only possess a money value of great extent, but will tend to divert the minds of the little ones into grooves that will ever after prove their moral safeguards.

The Planets.

MARCH, 1883.

(All Computations are for the Latitude and Meridian of New York City.)

Mercury will be visible for the second time this year March 3-6, being at greatest elongation on the 3d, and brightest for three days thereafter. The elongation being western, Mercury will be a morning star, rising before the Sun, and at a point somewhat south of the sunrise point. This will not be as favorable a time to see him as at his next elongation, May 14. He rises on the 5th at 5h. 29m., just one hour before the Sun, and will therefore be visible for a few minutes.

Venus will be stationary on the 26th, and she will vary but very little in her time of rising throughout the month, being at 4.17 A.M. on the 10th, and 4.12 A.M. on the 25th. She will be 3° south of the Moon on the 5th, being near the cluster of stars marking the head of the Goat. She now presents a slightly gibbous phase, which will gradually approach a complete circle as the summer months pass.

Mars will continue to be a morning star until next November. He is still a very late riser, receding from the Sun very slowly, and rising about 6 o'clock in the morning.

Jupiter reaches his eastern quadrature on the 13th, still shining with great lustre. The great Crab Nebula is just to the right or west of him, and about 1° above the third magnitude star *Zeta Tauri*, which, with the third magnitude star *Beta Aurigæ*, marks the tips of the Bull's

horns. Jupiter is completely surrounded by interesting and beautiful objects. The Seven Stars, or Pleiades, Saturn, and the Hyades, are upon the west or right; Capella, the Kids, and the Segment of Perseus north of him; Castor and Pollux, and the other bright stars of the constellation Gemini, with Cancer and the faint little cluster of stars called Præsepe, are to the left. Near Præsepe is a very noted triple star, *Beta Cancri* or Tegmine by name. This star may be readily found by being pointed at by Castor and Pollux, and at double their distance apart from the latter. Two of the members of this system perform a binary revolution in about sixty years, and the other performs a grand orbital ellipse in five or six hundred years. This and many others go far to verify the theory that each star of the firmament is but the central member of a solar system similar to our own. Suppose an observer situated outside of our system, at a point sufficiently distant as to render all but the Sun invisible to the naked eye, and the Sun reduced in apparent size to the grade of a second or third magnitude star. Then, with a powerful telescope, he would see the two giant and partially self-luminous planets, Jupiter and Saturn, as attendants upon the star, making a triple star. Thus all star systems, binary, triple, quadruple, and septuple, would seem to be but visible portions of large systems having a common centre of gravity. Orion is between Jupiter and the southern horizon, Betelguese (pronounced Be-del-gæze ?) being nearly midway between Jupiter and the King or Belt of Orion.

Eclipses of Jupiter's satellites may be seen in the early evening hours, as follows: March 5th, 9.51 reap.; 13th, 9.10 reap.; 21st, 8.11 reap.; 28th, 10.7 reap.; 31st, 7.8 reap. It will be interesting to witness the *entire* eclipse of the fourth satellite on the 18th, beginning at 10h. 40m. 29s., and ending at 11h. 39m. 13s. The following Jovian events will also be visible in the evenings of March:

Occultations.

Sat.	*D.*	*H.*	*M.*	
III.	2	7	3	disap.
III.	2	9	48	reap.
I.	5	6	18	disap.
II.	27	9	6	disap.

Transits.

Sat.	*D.*	*H.*	*M.*	*Phase.*
I.	4	9	5	ingress.
II.	4	9	22	egress.
II.	11	9	13	ingress.
I.	13	7	43	egress.
I.	20	7	22	ingress.
III.	20	7	54	egress.
I.	20	9	38	egress.
IV.	26	7	55	ingress.
IV.	26	8	0	egress.
III.	27	9	11	ingress.
I.	27	9	20	ingress.

It will be seen that on the 26th, Sat. IV. makes a transit occupying only five minutes. These events are of rare occurrence, this being the only one visible until next September. The apparent semi-diameter of Jupiter at the time of this transit is about 18″, while the distance of the fourth satellite south of the major axis of the ellipse in which the satellite moves is 17″. It will thus be seen why the transit is of such short duration.

Saturn is in the eastern part of the constellation Aries, where a line from Sirius, through the Belt of Orion or the Kings, will touch him, when produced as far again. He will be 1° south of the Moon on the 13th, and sets on the 10th at 11h. 4m. eve.; 25th, 10h. 12m. eve.

Uranus arrives at opposition on the 12th, and will be brightest at that time, being readily picked up by good eyes. He presents no phenomena of interest to the telescopist, not even his four satellites being visible except with the very best telescopes. Every person, however, who knows anything at all of the heavenly bodies, should be able to say that they have seen all the planets visible to the naked eye.

Uranus passes the meridian as follows:

March	5	0	40	morn.	Dec. 4° 4′+
"	15	11	55	eve.	Dec. 4° 15′+
"	20	11	14	eve.	Dec. 4° 25′+
"	25	10	50	eve.	Dec. 4° 31′+

Look for him on a line between Regulus and Spica Virginis, and just about midway between them. The third magnitude star *Beta Leonis* is very close to him, being but one degree north.

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS, MARCH 21, 1883.

		H.	*M.*
Alpha Andromeda (Alpheratz) sets		7	57 eve.
Omicron Ceti (Mira) variable	"	8	5 "
Beta Persei (Algol) variable	"	0	38 mor.
Eta Tauri (Alcyone or Light of Pleiades) sets		11	12 eve.
Alpha Tauri (Aldebaran) sets		11	30 "
Alpha Aurigæ (Capella) in merid.		5	12 "
Beta Orionis (Rigel)	"	5	13 "
Alpha Orionis (Betelguese)	"	5	53 "
Alpha Canis Majoris (Sirius or Dog Star) in merid.		6	44 "
Alpha Canis Minoris (Procyon) in meridian		7	37 "
Alpha Leonis (Regulus) in merid.		10	5 "
Alpha Virginis (Spica) rises		7	59 "
Alpha Bootis (Arcturus) "		7	2 "
Alpha Scorpionis (Antares) rises		0	9 mor.
Alpha Lyrae (Vega)	"	9	42 eve.
Alpha Aquillae (Altair)	"	1	22 mor.
Alpha Cygni (Deneb)	"	10	45 eve.
Alpha Pisces Australis (Fomalhaut) invisible.			

Penn Yan, Yates Co., N. Y.

How to Drive a Nail.

The following notes contain information that is familiar to all experienced workmen, but is probably new to many of the readers of the YOUNG SCIENTIST. We take it from the excellent catalogue of Bee-Hives and other Apiarian Supplies of A. I. Root, of Medina, Ohio:

"Much depends on having a hammer just right for the work that is to be done. I often see people (women especially, begging their pardon) try to drive a small, slender nail, into light work, with a very heavy hammer. The nail doubles up, the work splits, their fingers get pounded, and it is no wonder they conclude in disgust that carpentry is not their forte. Trying to drive a large nail with a light hammer is not so bad, but it is a great waste of time and strength. Every bee keeper should have at least three sizes of hammers. You can drive a common brass pin its whole length into a pine board with a hammer of the right weight; but should you try to do it with a hammer that is too heavy you would double it up the first clip. In watch work, we frequently require hammers weighing scarcely more than a quarter of an ounce."

Novelties for Amateurs.

We intend to reserve this department for the description and illustration of such tools, appliances, instruments, devices, and methods, as may be brought to our notice, and that we think will be of use or interest to our readers. Whatever may be brought under discussion in this column will only receive the views of ourselves, as we do not intend to be biased by interest or by the sayings or offers of manufacturers or inventors. In other words, we do not intend to be bribed by advertising or other patronage to praise or condemn an article, if, from our point of view, it does not deserve such.

If we think an article good, we shall not hesitate to say so. The same rule will obtain if the article is not such as represented. Indeed, we shall feel it incumbent upon us to keep the readers of the YOUNG SCIENTIST informed of all inventions, devices, etc., etc., that we may be advised of, and that may be of use to them, and to warn them against purchasing the "cheap John" and "catchpenny" stuff that is so freely advertised all over the country.

Of course, we shall be pleased to receive samples of tools, instruments, materials, or anything suitable for the young experimenter or amateur worker, for examination, and if they are such as we think will be appropriate for use to any of our young readers, we shall gladly give a notice thereof, and illustrate, where necessary, showing up their good features and pointing out their defects.

No doubt there will be cases where our obtaining a specimen will be out of the question, as the articles may be too large or too expensive. In such cases, "Mahomet will go to the mountain," but we shall see to it that our readers do not suffer in consequence. Now, in every notice that may be written of any article, be it what it may, it is our intention to give all the particulars we can obtain regarding it, fully and clearly, believing it to be in the interest of both buyer and seller that this should be done. That there are those who are averse to this method, we are fully aware, as they think that publishers or editors must derive some benefit or other by saying all about an article, its price, and where and of whom it is to be bought. Such a supposition is as absurd as it is groundless; the publicity that is accorded to any article is, after all, in the interest of those who may be inclined to buy, rather than that of the makers and sellers; and of those who would infer that the submittal of any manufactured article for notice inclines the person who has to weigh its merits to decide in its favor, we would ask if they would think for a moment that the sending of a book for review has anything to do with influencing the opinion of the reviewer? And as with book reviews, so is it with notices of articles composed of other materials than paper, cloth, and pasteboard.

Having thus defined our position, and endeavored to show that neither publishers nor editors do or can derive any benefit from the notices of articles, we may point out to inventors and makers that any article they may send to be examined and tested shall receive fair and impartial consideration. Examination and test are as necessary to the review, so to speak, of a plane or saw as of a book, or of a drilling-machine as of a periodical; taking this view of the matter, we trust that manufacturers and makers who desire to have their specialties mentioned in the YOUNG SCIENTIST will send their articles at an early date, so that we may have ample time to do justice to the subject.

Visitors to the American Institute Fair, New York City, last fall, no doubt saw, in the entrance leading to the Art Gallery, several specimens of the Gate's Folding-Table. These tables are certainly very ingenious contrivances, being so small that they may be used for a writing-desk, as they can be tipped to any angle to suit the writer. They may also be made to answer as a book-rest, as the top is provided with a movable ledge, which may be attached near the lower edge of the table top when it is tilted.

and which prevents the book from sliding off. The adjustment for regulating the height of the table is very complete and effective. The central post is formed of two parts, and is made of metal nickel-plated; the upper half drops into the lower part, and which contains a strong spiral spring, which forces the top to the required height, where it is firmly held by a screw-clip. A little pressure on the top of the table will force the top down, when it may be securely fastened. When the table is not in use, it may be folded up, legs and all, and laid away in any place, with the face of the top against the wall.

The dimensions of the top are 30x23 inches, just the size required for a small drawing-table or for a game-table. Perhaps the amateur or scientific student who is hemmed-in by narrow limits, and who has not time or inclination to make a table suitable for his purposes, might find this to answer quite well.

The Challenge Scroll-saw, manufactured by the Seneca Manufacturing Co , Seneca Falls, N. Y., has recently been improved to such an extent that it is now one of the best saws available for

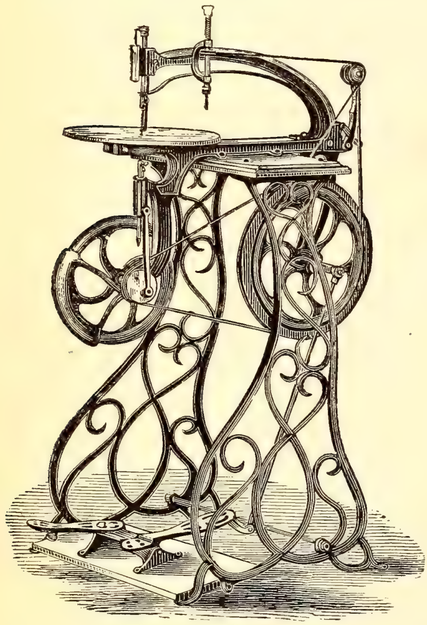


Fig. 1.

executing the finer kinds of work. The engraving, Fig. 1, shows the saw in working trim, with boring attachment, blower and all complete. An excellent feature in this saw is the method in which the table is connected to the saw, which is accomplished by a ball and socket joint. The ball is hollow, and the saw passes clean through it, there being ample room left for the saw to work without interference. The main object of the ball and socket joint is to enable the sawyer to tilt the table to any desired position for sawing inlaid work or cutting material on a rake. The table is held in position

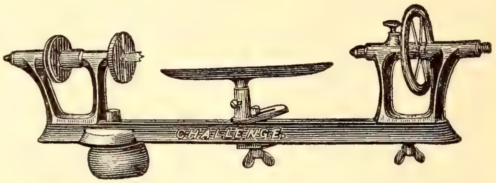


Fig. 2.

by means of a clamp, which is attached to the joint, and which may be tightened or loosened at will by simply turning a nut which forms part of the clamp.

As a rule, the most unsatisfactory part about a scroll-saw is the device for holding the saw in place. This difficulty has, in a measure, been removed in this machine, as it is provided with an excellent device for holding the saw in a firm grip. A slot is made in the spindle, terminating in a small hole drilled through; a small bolt passes through the spindle below the hole; on the end of the bolt is attached a thumb-screw, which can be tightened or loosened at will. The spindles are made from the best of Hobson steel, and are spring-tempered, so that the saw cannot slip when properly held, or tear or disfigure the spindle in any way.

The slots in the spindles are directly in line with the line of centre of spindles, which insures the true working of the saw, which is a very important matter in scroll-sawing.

The workmanship on these machines is of the best kind, every part of it seemingly as perfect as hands and tools can make, and any part can be duplicated by sending to the manufactory. The capacity of the saw is to cut wood up to one inch thick, and it will take in from fourteen to fifteen inches between the saw and the frame; it is not liable to get out of order with fair usage, and is suited admirably to the wants of amateurs, shell, bone, and ivory workers. Metal may also be cut on this machine, if the plates are not too thick. The saw complete, without lathe attachment, weighs sixty-five pounds.

Fig. 2 shows the lathe attachment for the Challenge saw. It is made of iron and steel; length of bed, 18 inches; distance between

centres, 11 inches, and swings 4 inches; rests, 4 and 8 inches. It has a solid emery wheel for grinding and polishing tools, metals, etc. The head has a spindle of steel, nicely fitted, with face plate, spur centre, etc. The tail stock has a screw spindle of steel, with wheel, etc. It is fastened to the saw frame with the ball and socket joint, the same as used for the tilting-table. The saw and lathe are sold separate.

Our Book Table.

The Empire City Philatelist. A. M. Crouter, Editor and Publisher, 155 West Broadway, New York. Published monthly; 50 cents per year.

This publication is devoted to the interests of stamp and coin collectors. To those of our readers who are making collections of either stamps or coins, this journal would prove of great interest, as it describes the various stamps as they are issued, and contains considerable gossip regarding collections and collectors, sales of stamps, coins, and medals, and newsy chats of doings in the post-office department. Each number also contains contributions and correspondence from foreign countries concerning post-offices, postage-stamps, and old coins. The journal has many other pleasing features, and on the whole is a paper that will well repay its cost to all who are interested in the collection of postage-stamps, numismatics or coin collecting.

Scientific News.

—It has been popularly supposed that the rings of a tree furnished a reliable record of its age in years. But Dr. A. L. Child writes to the *Popular Science Monthly* that this idea is erroneous. His experiments go to show that the formation and thickness of the rings depend upon the changes in the atmosphere, and the more frequent these changes the greater the number of rings. Trees which he knew to be only twelve years old proved, upon being cut, to have thirty-five to forty rings.

—On the authority of Mr. Woodbury, of Boston, it is stated that 40-light Brush dynamos in use at Adams, Mass., require 36 and a fraction horse-power each. The cost of running arc lights in various steam mills, running, when lighted, 400 hours per year, is estimated by him at 6½ cents per hour, of which 1½ cents are for carbon, and 5 cents for coal, attendance, depreciation and interest. When a mill runs nights the hourly cost is considerably diminished. Where arc lights are substituted for kerosene lamps the ratio between the two was, in one case mentioned, one arc light for eight kerosene lamps. These facts are of great importance to manufacturers.

—A late report of a patented method of making artificial wood comes from Germany, where Herr B. Harrass has invented and put into practical operation a process which consists of the manipulation of a mass consisting chiefly of cellulose and starch. Common cellulose, sold in the form of paper, is reduced to pulp in water. To this is added, after being drained through a sieve, three parts by weight of starch and two parts by weight of wheat or maize meal. The compound, thoroughly mixed, is put into tubes of thin metal and boiled over a water bath. When done the allotted time, and turned out after cooling, the mass resembles glue, which is then mixed with the same quantity of sawdust. This mass is rolled and left to dry in a hot room, and is then ready for use. For pressing into the desired shape iron or steel moulds are used, heated to 120 degrees, and the mass is subjected to enormous pressure. After cooling, the article is said to resemble wood, and can be treated in every respect as such, becoming with age bone-hard. It can be worked with the saw or file, can be colored, polished, and, when desired, covered with veneer.

—The cultivation of the singular parasitic shrub mistletoe for ornamental purposes is recommended in foreign papers, and young trees with mistletoe growing on them are offered for sale in English nurseries. It is generally found on the branches of apple-trees, but is not very particular in this respect, and takes its habitation also on different other trees. It may be raised from seed placed in the crevices of the bark of young, healthy branches; or it may be propagated by grafting, in which case, a piece with a portion of the bark of the tree from which it is taken has to be cut with it, and firmly secured to the new position. The European species is larger and rather more ornamental than our native kind, for which reason the latter might not prove a success for exclusively ornamental purposes; but if some enterprising florist should succeed in raising mistletoe in neat hanging-baskets, which might be hung ingeniously over doors and archways under which young people of both sexes have to pass—and older ones, too, for that matter—there might spring up quite a demand for the "novelty" about Christmas-time.

Practical Hints

Holes in Glass.—It is said that a round hole of any desired size may be cut in a pane of glass without injury to the pane by taking a copper tube of the size of the hole required and causing it to revolve in contact with the glass, keeping the surface where the cut is to be made well supplied with emery and water. Of course, care must be taken to hold the glass firmly down and to prevent the tube from moving away from the spot where the hole is to be cut.

Polishes.—The following is said to be a very effective polish:—Dissolve four ounces of orange shellac in one quart of ninety-five per cent. alcohol, and when the shellac is dissolved add one quart of linseed oil and one pint of turpentine. Mix the ingredients, and when thoroughly incorporated add four ounces of sulphuric ether and the same quantity of liquor ammonia. Stir well before using, and apply with a cloth or sponge, rubbing the surface to which it is applied till the polish appears.

Glue-Pot.—There are a great many times when a glue-pot in the house is a "well-spring of pleasure," and is an economical investment, especially when one of the kind here described: Buy at a tin-shop one small tin cup, costing five cents, and a larger one, costing about ten, in which the smaller one can be set; five or six cents' worth of glue will mend a great many broken articles, or will fasten the things that have become unglued. Put the glue in the small cup with a little water; put boiling water in the larger one, and set the glue-pot in it; in a short time the glue will melt and be ready for use.

To Remove Rusted Bolts.—The most effectual means for the removal of bolts that have rusted in, without breaking them, is the liberal application of petroleum. Care must be taken that the petroleum shall reach the rusted parts, and some time must be allowed to give it a chance to penetrate beneath and soften the layer of rust before the attempt to remove the bolt is made. Bolts and studs on which the nuts are fixed with rust are broken off through impatience. In most cases a small funnel built round a stud or bolt end on the nut with a little clay, and partly filled with any of the searching petroleum oils, and left for a few hours, will enable the bolt or nut to be moved.

Distempering Ceilings.—Give the ceilings a coat composed of soft soap, lime, putty, and size. The quantities to be used of each ingredient entirely depend on the finish of the ceiling; some are much more absorbent than others. The soft soap prevents the dry plaster absorbing the color too quickly, so that a clean, even surface may be obtained with the finishing coat. If the workman is not a practiced hand, he may be successful in laying an even coat of distemper; and even if he should succeed, if his ceiling is gray-finished, the sand will probably spoil the distemper. A remedy for this would be to cover the ceiling with lining paper and distemper on the paper, but experience is here also required in hanging the paper. Very little size is required for distemper—just sufficient to cause the color to adhere firmly.

Frosting Leaves.—Alum frosting for leaves is both simple and harmless. Dissolve alum in boiling water, in proportion of a pound to a quart. Pour it into a deep vessel, and as the solution cools, the alum will be precipitated. Choose light sprays, and hang them with the stems upwards on cords stretched across the top of the vessel, so that they do not touch the bottom; the stalks will attract the alum in the process of crystallization like the threads of sugar-candy. The warmer the solution when the sprays are put in, the smaller will be the crystals attached to them, but care must be taken that it be not hot enough to destroy the leaves or fronds; and if there be berries, like holly, it must be hardly lukewarm. The same solution warmed again will do two or three times. If the sprays are frosted some days before being required, they must be kept in a warm, dry atmosphere.

Notes and Queries.

In continuing this department, which has been found of so much value, we would remind our readers who wish for information on any of the arts and sciences, that they are cordially invited to make their wants known through this column, and those of them who can furnish accurate answers to questions asked are requested to send in replies. Doubtless many of our subscribers may know of methods, processes, or devices that may be better or more suitable for the particular case in question than anything generally known, and it is this reason that induces us to keep this department open for a medium, where an interchange of ideas and practices may be made to the advantage of all our readers. Correspondents will please send their full address when forwarding their communications—either questions or answers—not for publication, unless expressly so stated, but so that we may know where to find the writer if desirable. Communications should be sent in on or before the first of each month previous to publication, to insure insertion in next issue.

Answers.

26. MATILDA, Newark, N. J.—There were many curious myths and superstitions believed in by the ancients regarding trees, flowers and shrubs, and it is not surprising that many of the heathen gods were honored by having some of the finer trees dedicated to them. The following is an incomplete list of such dedications:

FLOWERS AND TREES.

I. Dedicated to heathen gods—

The Cornel Cherry Tree	to Apollo.
" Cypress	" Pluto.
" Laurel	" Apollo.
" Myrtle	" Venus.
" Oak	" Jupiter.
" Olive	" Minerva.
" Pine Cone	" Assyrian Temples.
" Vine	" Bacchus.

II. Dedicated to saints—

The Rose	to Mary Magdalene.

III. National emblems—

The Linden (Lime)	to Prussia.
" Rose	" England.
" Shamrock	" Ireland.

IV. Symbols—

The Box, Holly, and Ivy, the	Resurrection.
" Cedar	Faithful.
" Olive	Peace.
" Orange Blossom	Virginity.
" Palm	Victory.
" Vine	Christ our life.
" Yew Tree	Death.

V. Funeral Plants.—The laurel, oak, olive, myrtle, rosemary, cypress, and amaranth.

The juice of the fir tree (turpentine) used to be mixed by the Greeks with new wine to make it keep; hence fixed on the Thyrsus (a pole wreathed with ivy) as one of the symbols of the god Bacchus.

A modern Greek legend invests the holm oak with a very bad reputation. When the crucifixion was about to take place, all the trees met to-

gether and determined not to lend their wood to the construction of the cross. They all kept their word except the holm oak. The other trees broke in pieces when an attempt was made to utilize them for cross-making. The holm oak alone allowed itself to be made use of; wherefore it is looked upon as accursed. Wild chicory has been made the subject of many legends, especially in Germany, where it is known by several names, one of them being *wegewarte*, or road-guardian. The popular explanation of the term is as follows: A young princess whom her beloved spouse had abandoned, declared that she would like to die, but yet she longed to see the loved one again; and the maidens who bore her company expressed a similar desire. Their wishes were realized. They were turned into flowers, white and blue, and stationed along the sides of roads, so as to be able to see the loved and lost prince whenever he rode by. And since that time the plant has been called the guardian of roads.

27. Tom H., Providence, R. I.—The divining rod, or, as it is called in this country, the "Witch-Hazel," is a forked branch of hazel, suspended by two prongs between the balls of the thumbs. The inclination of the rod indicates the presence of water-springs, precious metals, and anything else that simpletons will pay for. This is a very ancient belief which pertains to the yet lingering practice of witchcraft. There are many people in this country who believe in the efficacy of this method for determining the whereabouts of water-springs, etc.; and in Continental Europe, even amongst the educated classes, there are many persons who would not think for a moment of sinking a well without first consulting an expert diviner, and, indeed, many of these diviners may be found among the ecclesiastics, who make it a source of income. The action of the "Witch-Hazel" in the hands of some people has never yet been satisfactorily explained, but is supposed to be the result of unconscious effort on the part of the holder. It may be safely stated, however, that the presence of water or precious metals has nothing to do with the movements of the twig.

28. Monograms, J. H. P., Brooklyn, N. Y.—I enclose three monograms of the initials J. H. P., T. W. T., and S. N. B., and hope they will suit your querists. If these are satisfactory, I shall be pleased to send others for publication, if your subscribers will make known their wants in this line. I am very much pleased with the Young Scientist, and expect to send you a big club from this city before long, as I am going to make an effort to capture that gold watch you offer as a premium for the largest number of subscriptions sent to you during the present year.—X., Cincinnati, O.

Note.—We shall be pleased to award the watch to friend X., and hope he will have the success he expects and deserves in obtaining names for the Young Scientist. We hope all of our young readers will take an interest in this extra premium scheme. We invite all our readers—boys and girls—to carefully read the second page of front cover, and see the fine chances we are offering them for obtaining something useful, and at the same time making money on the commissions offered. We shall be pleased to give any further information on this matter to such of our readers as may require it, if they will communicate with us on the subject.

29. Nina, Toledo, O.—If Nina will adhere to the following instructions, she will obtain excellent results:

Cut from the lithograph or engraving you wish to transfer, all the margin, then lay it in a pan of tepid water until it sinks, after which remove it and place it between dry papers to dry. This done, clean a square or oval piece of glass and wipe dry; cover it with Damar varnish, spreading it on evenly with a flat varnish brush. This done, lay away until nearly dry, so it will not stick to your fingers when touched, but snap when your finger is removed; then lay your picture upon any smooth surface, with the right side up, and hold your varnished glass on it with the varnished side down in the position you want the picture on the glass. Lay the glass down carefully; this will unite the glass and the face of the picture.

Next take a piece of dry paper and lay on the back of the picture. Where air bubbles or blisters are seen, press them lightly with your fingers from the centre of the picture outwards. Do not let a single one remain, and always keep a dry paper between your fingers and the picture, or you will roll up the paper and spoil the picture.

When the blisters are all removed, set away until the varnish is dry, which will take about twelve hours. Wet the paper with water, and rub it with your fingers until all the paper is removed but a light film; then set away for twenty minutes; varnish again with Damar varnish, and that will make it clear and transparent. When the picture is well dried, paint it on the wrong side, following the boundary and covering the surface and form of every figure and portion of your design as designated by your picture, using artists' colors and brushes. Lay your colors on heavily; mix them with Damar varnish before using. No shading is required, as that is given by the engraving. In painting the figure of a person, first paint the eyes and hair, let them dry; then the flesh color; then the draperies and backgrounds. Paint very carefully, and do not let the colors run into each other. In painting the eyes, first paint the white of the eye with silver white; for the pupil, ivory black; for blue eyes, Prussian blue and silver white mixed; for hazel, yellow ochre, Vandyke brown and a little raw sienna mixed. For flesh tints mix Naples yellow, scarlet lake, and silver white to the desired tint.

S N B.

T W T.

J H P.

Colors for drapery are: Buff, Naples yellow; orange, chrome yellow and a little scarlet lake mixed; white, silver white; blue, white and Persian blue mixed; green, chrome yellow and Persian blue mixed; purple, scarlet lake and Prussian blue.

For jewelry use yellow ochre; for silver and pearls, silver white.

For trunks and branches of trees, Vandyke brown, raw sienna and silver white mixed; foliage, mix chrome yellow and Prussian blue, and vary with the browns; for earth, raw sienna and white mixed; rocks, Vandyke brown, white and raw sienna mixed; water, Prussian blue, white and a small quantity of green; distant hills, make it a little deeper blue; the sky, Prussian blue and white, applied as follows: First paint the portion next to the tops of the hills, trees, etc., with entire white; then mix a very small quantity of Prussian blue as you go upwards on the picture. If you wish a warm appearance on the horizon, mix a small quantity of scarlet lake to give it a red tinge. Colors generally used for backgrounds are Vandyke brown, raw sienna and white, varied light or dark with more or less white mixed with it; or backgrounds can be painted after the rest is done by mixing all the different sorts together that are left.

If you make a false stroke you can remove the paint with a rag dipped in turpentine. The brushes may also be cleaned in the same way.

To make a transparency for hanging in the window after you have made the picture transparent according to the directions given above, place a second glass on the back, bind the edges with a thin paper, and when dry paste over this strips of bookbinders' cloth. When you put this on, paste along the sides a piece of narrow ribbon or tape, allowing it to project out over the two upper corners in the form of two short loops through which a cord can be passed to hang it up by. Pictures for transparencies cannot be painted, but a colored engraving can be used.—A. B.

30. H.,N. Y., sends the following: "Is the answer to R. G. (2), February number, concerning 'The Swiss Family Robinson,' wherein it was stated that the book was written by J. H. Kampe, correct? Now, in a French edition in my possession the author is said to be John Rudolph Wyss, born at Berne, March 13, 1781; died at Berne, March 31, 1830. His father had planned the work, but John Rudolph Wyss wrote it. Who is correct, S. K. or I?"

NOTE.—Formerly there was some doubt as to the authorship of this fascinating work, and it was ascribed to a number of sources; it has been ascertained latterly, however, beyond doubt, that the book is the work of Kampe, Humboldt's tutor. Miss Yonge, who is an excellent authority on the subject, says: "No one but a German could have thought it practicable to land a whole family in a row of washing-tubs nailed together between planks, on a desert island." The work was doubtless suggested by De Foe's "Robinson Crusoe." The two monograms you send us in reply to J. H. P. and T. W. T. (query 23), arrived too late to get the cuts made early enough for the present issue. They will appear in our April number.

Queries.

31. J. S., Somerville, N. J.—If you drop a postal-card to Peck & Snyder, 126–130 Nassau St., New York City, they will send you a catalogue containing all the information you ask for concerning ice and roller-skates.

32. MONOGRAMS.—G. F. M., A. B., and G. S., ask for monograms of those initials, and request some of our competent readers to forward designs to this office for publication.

33. INLAID MONOGRAM.—E. B. desires a monogram of his initials for inlay, to be cut with an ordinary Challenge scroll-saw. The work is intended for the top of a glove-box, and the design would be preferred on an oblong or oval background. "Please state, also, the kinds of wood that would be the most suitable for designs sent."—E. B., Atlanta, Ga.

34. OVERLAY DESIGNS.—If not asking too much of you, I should feel under obligations if you would publish a few designs for overlay fret-work, suitable for the panels of a wardrobe or chiffoniere. Perhaps some brother subscriber would kindly contribute such designs as I require.—ROBERT H., Erie, Pa.

35. KATY V. desires to know (1st) What is meant by the language of colors? (2d) When did type-writing machines first come into vogue, and what they are like?—Louisville, Ky.

36. PAINTING ON SATIN.—Will you kindly inform me how this kind of work is done, and name the materials employed?—A COUNTRY GIRL.

37. REVENUE MARINE SERVICE.—What requirements and qualifications are necessary to obtain an appointment in this service?—HARRY S., Phila, Pa.

38. M. H., Homestead, Ia.—Will you please inform me where I can purchase the shells for ornamental shell-work quoted in your market reports?

NOTE.—Several inquiries of this kind have reached us of late, and we have been obliged to give the answers by mail. Hereafter we hope to be able to give our readers much of this sort of information through our advertising columns. It will always give us pleasure to reply by mail or otherwise to all inquiries of this kind, and we hope our readers will note this fact and write us freely for any information we may be able to afford.

39. J. A., Colela, Ia.—Will some reader inform me how many bones there are in the human body? There appears to be a difference on the subject among reputed authorities. One says there are 204, another 246, and still another 260, and in a recent newspaper article I notice the number is placed at 202. Now which is right, or are any of the foregoing figures right?

40. QUINER.—As myself and others are interested in the art of pottery, a few practical hints on glazing, preparing clay, etc., in the YOUNG SCIENTIST, would be duly appreciated.

Market Report.

Retail Prices.

IMPORTED CAGE BIRDS.

Canaries, *Belgian*, per pair	$6.00 to 15.00
" *French*, each	6.00 to 15.00
" *German, Hartz Mts.*, each	2.50 to 10.00
Gold Finches, each	1.50
Gold Finch (mules), each	2.50 to 5.00
Bull Finches, each	2.50
Bull Finches (tuned), each	10.00 to 40.00
African Finches, per pair	2.50 to 5.00
Chaf Finches, each	1.50
Linnets, each	1.50 to 2.00
Linnets (mules), each	2.50 to 5.00
Green Linnets, each	1.50
Java Sparrows (blue), each	1.50
Java Sparrows (white), per pair	4.00 to 6.00
English Sparrows, per pair	1.00

Siskins, each	$1.00
Gray Cardinal, each	4.00 to 5.00
Nightingales, each	8.00 to 25.00
Japanese Nightingales, each	5.00 to 10.00
Thrushes, each	5.00
Skylarks, each	5.00
Troopials, each	7.00 to 12.00
European blackbirds, each	5 00
Black-caps, each	4.00
Starlings, each	4.00 to 6.00
Ring Doves, each	2.50 to 3.00

AMERICAN CAGE BIRDS.

Canaries, each	2.50
Mocking Birds, females, each	1.00
" " singers	12.00
Robins	2.50 to 5.00
Blue Birds ("Blue Robins") each	1.50 to 2.00
Indigo Birds, each	1.00
Nonpariel, each	1.50 to 2.00
Virginia Cardinal, each	3.00
Bobolinks, each	1.50 to 2.00
Yellow Birds, each	1.50 to 2.00

QUADRUPEDS.

Terriers, *black and tan*, each	5.00 to 30.00
Terriers, *Scotch and Skye*, each	5.00 to 30.00
Newfoundland Pups, each	10.00 to 15.00
Pomeranian or Spitz "	5.00 to 15.00
Greyhounds, *English*, "	10.00 to 25.00
Greyounds, *Italian*, "	10.00 to 30.00
Guinea-Pigs, *common*, per pair	1.50
" " " " large	1.50 to 3.00
Guinea-Pigs, *all white*, "	2.00 to 4.00
Squirrels, *gray*, "	5.00
Squirrels, *all white* "	15.00 to 25.00
Squirrels, *flying* "	3.00 to 4.00
Squirrels, *small red* "	2.00
Rabbits, *common*, per pair	1.00 to 2.50
Rabbits, *fancy breed*, according to age and purity of breed, per pair	3.00 to 15.00
Ferrets, *English*, "	15.00
Raccoons, each	4.00 to 5.00
Cats, *Maltese* (males), each	5.00
" " (females), each	3.00
Cats, *Albinos, pink or blue eyes*, each	3.00 to 5.00
Rats, *white China, pink eyes*, per pair	1.50
Rats, *piebald*, per pair	1.50
Mice, *white, pink eyes*, per pair	0.50
Mice, *piebald*, per pair	0.50

Prices Paid for Pet Stock by Dealers.

At this season of the year the prices paid for pet stock of all kinds are very low; this is on account of the demand for said stock falling off greatly after the holidays. Rabbits (common) are now ranging from 50 to 75 cents per pair, according to age and color.

Guinea-Pigs, per pair	$0.40 to 0 75
Squirrels, *gray*, each	0.50 to 1.00
Squirrels, *flying*, per pair	0.25 to 0.50
White mice, per pair	0.15 to 0 20

MARINE AQUARIA STOCK.

Fringed Sea Anemone, Medium-sized specimens	1.50
White-Armed Anemone	0.50
Small Orange "	0.10
Buccinum Snails, per dozen	0.25
Small Crabs, each	0.25
Silver Shrimp, each	0.10
Small Hermit Crabs, each	0.15
Small Spider " "	0.25
Barnacles, each	0.15
Lebia Fish, each	0.25
Killie " "	0 10
Eels, "	0.10
Serpulæ, per mass	0.75
Edible Mussels, per mass	0.25

ALGÆ "SEA-WEEDS."

Ulva, per mass	0.25 to 0.50
Solaria, "	0.25 to 0.50

FRESH WATER AQUARIA STOCK.

FRESH-WATER STOCK.

Stickle Backs, Nest-building, per pair........ 0.30

Plants, per bunch	0.15	Small Turtles, per pair.	0.25
Shells, per quart	0.50	Snails, per dozen	0.20
Small Dip-Nets	0.50	Frogs, each	0.25
Aquaria Cement 1 lb. box	0.30	Fresh-Water Mussels	0.10

Valisneria Spiralis, per bunch	0.25	For the Microscope and Fresh Water Aquarium.
Nitella-Flexilis, "	0.25	
Anacharis, "	0 25	

Small Rock-Fish, Sun-Fish, Dace, Cat-Fish, Tadpoles, Eels, Lizards, each 0.10

Gold-Fish		These are all varieties of the golden carp or gold-fish.
Pearl-Fish		
Silver-Fish		
Japanese King-gio	2.00	

Prices Paid by Dealers.

At this season of the year all stock for aquaria brings a high price.

Aquarium fish (*now scarce*) per hundred	1.50 to 2.00
Gold Fish (*now scarce*) per hundred	8.00 to 10.00
Aquarium Plants (*now scarce*) per hundred bunches	5.00

SHELLS.

Collections of small "cabinet" shells for schools, private cabinets, range from $5.00 to $50 00.

Mother-of-pearl shells, for painting, 75 cts. to $1.50.

Single specimens of cabinet shells range from 25 cts. each to $3.00.

Masses of corals, 50 cts. to $3.00.

Green snail and cowry, with the Lord's Prayer engraved on them, 50 cts. to $2.50 each.

Conch shells, for mantels or hearthstone ornaments: West India Conch, 25 cts.; East India Yellow Helmet, $1.00 to $2.50; Bahama Black Helmet, 50 cts. to $1 50; Bahama Hatchet Helmet, 50 cts. to $1.25. These shells are also for cameo engraving. Zanzibar Cameo, 25 cts. to $1.00.

Ground and polished shells: New Zealand Green Ear, 50 to 75 cts.; New Zealand White Ear, 50 to 75 cts.; Japan Black Ear, 50 cts. to $1.00; California Red Ear, 75 cts. to $1.25.

Fine shells for fancy work, according to colors and variety, per quart, $1.00 and up.

Fancy Wood for Scroll Sawing.

The prices given for the various woods used in this work are for the best of qualities of seasoned material, planed on both sides, ready for immediate use. They can be furnished in quantities to suit purchasers. Prices are by the square foot, and vary according to thickness of material.

DESCRIPTION.		THICKNESS. 1-8	3-16	1-4
Black Walnut	Per Ft.	7	8	10
White Holly	"	10	12	14
Oak or Ash	"	8	10	12
Mahogany	"	10	12	14
Red Cedar	"	10	12	14
Rosewood	"	18	20	25
Satinwood	"	25	30	35
Birds'-Eye Maple	"	15	18	20
Tulip	"	30	40	50
Ebony	"	50	60	70
Cocobola	"	20	25	30
Amaranth	"	20	22	25

BEST IMPORTED SAW BLADES. 5 INCHES LONG.

Sizes to No. 6, per dozen	10c
" " " gross	$1.co
" No. 7 and 8, per dozen	15c
" " " " gross	1.25
" No. 8 and 10, " dozen	20c
" " " " gross	1.50

For all information on this subject, as to reliable dealers, etc., etc., send postal card to YOUNG SCIENTIST. When desired, the goods can be sent through this office, but in all cases remittances must accompany the order.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business matter in letters or cards they are filed away and never reach the printer.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

Silver watch, key-winder and Home Works, for good microscope or offers. Wm. Hodgson, 128 Mangin St., New York City.

A small collection of coleoptera, comprising 100 species and 300 specimens, all correctly named, in exchange for bird-skins, insects, books, or eggs. Emil Laurent, 621 Marshall St., Phila., Pa.

A small magic lantern, Ruby pattern, with twelve slides, for a good book on Entomology, with illustrations. Willie R. Hotchkiss, Morrisdale Mines, Clearfield Co., Pa.

Wanted, Thompson's "Witchery of Archery." Must be in good condition. Write before you send. J. Anthony, Jr., Coleta, Whiteside Co., Illinois.

A telescope worth $3.50, for a self-inking printing-press and outfit; chase not less than 2½ by 3½ in. Eddie Judd, 260 Connecticut St., Buffalo, N.Y.

To exchange for offers: $20 scroll-saw, Seneca Falls make, $4 Bailey circular plane, set of Auburn metallic planes, brass-bound four-foot rule, fourfold, Traut's patent combined plow, dado, etc., cost $7. F. A. Rappleye, P.O. Box 12, Farmer Village, Seneca Co., N.Y.

Bee Hive wanted; one of the old-fashioned straw "skeps"; say what you would like in exchange. Apis, care of Young Scientist, 49 Maiden Lane, N. Y.

A first-class type writer, in excellent condition, cost $125.00, to exchange for good microscope, telescope, or valuable scientific books; send full particulars. A. B., Box 114, Lewiston, Maine.

A $30 stencil outfit (Spencer's) for a self-inking printing press in good condition, chase about 6 x 9; rich ores and minerals of Idaho for scientific and instructive books, printing press, type, etc. J. P. Clough, Junction, Lemhi Co., Idaho.

Wanted pyrites of iron from Colorado gold mines in exchange for sea shells and other gems; send list of what you have to exchange. S. Ferguson, Eureka Springs, Arkansas.

Scientific specimens of various kinds for same. Geo. E. Frazier, Caldwell, Ohio.

A banjo in good condition, two pairs of rosewood bones, three splendid games, and a fine set of drawing instruments, for a good cornet, viola, violincello or double bass. L. B. Hill, Kalamazoo, Mich.

A good telescope, also foot-lathe and saw combined, each worth $10.00, for shells, fossils or relics. Independent, Conneautville, Crawford Co., Pa.

Birds' eggs to exchange for others; send list of what you have to exchange. Emil Laurent, 621 Marshall St., Philadelphia, Pa.

Lester W. Mann, Randolph, Mass., Box 162, has Demas scroll saw, lathe and tools, emery wheel; $20 worth patterns; Smithograph; large harmonica, cost $1.75; novelties in seeds; for large self-inking press or offers.

10 volumes Chambers' Encyclopædia, American Book Exchange edition (cloth); Bonanza printing press, chase 3 x 5, card type, ink roller; spyglass, power 10 times; for French triplet, 1-5 in., or offers. H. P. Nichols, P. O. Address, Bridgeport, Conn.

Twelve or fifteen volumes of the American Agriculturist to exchange for scientific books or offers. W. H. Osborne, Chardon, Ohio.

J. D. Rice, P. O. Box 473, Trenton, N. J., would be pleased to correspond with mineralogists for the purpose of exchanging specimens and ideas.

To exchange, my collection of nearly half a thousand rare postage stamps with catalogue, for second-hand Flobert rifle; must be in good condition. H. E. Whitman, Station M, New York.

I have a large assortment of foreign stamps to exchange, also Confederate money. Collectors send sheet and I will return it with mine. Box No. 2, Coeymans, N. Y.

Electric bell engine, cost $15; pair of analytical scales, cost $10; pair of Bell Telephones to exchange for a printing press, watch or offers. Geo. N. Bigelow, Box 754, Palmyra, N. Y.

Any person wishing to trade bird's eggs may apply to me and I will send them my list of bird's eggs. I have only a few at present, but am receiving a number every month. A. G. G., Box 26, Summit, New Jersey.

Minerals of Idaho for Standard Works on the Horse—Wallace's Registers and turf journals. Wanted, also other useful books, bound and in good condition. Many varieties named in my list. J. P. Clough, Junction Lemhi Co., Idaho.

To exchange for offers first four (fifth when completed) bound volumes of YOUNG SCIENTIST. J. N. Brooks, P.O. 1468, N. Y. City.

Wanted engraver's tools with book of instructions, for a Victor Press, with cabinet, 2 type cases, type, ink roller and furniture complete; perfectly new. L. Warren, 72 Cumberland St., Brooklyn, N. Y.

A Fletcher Foot-Blower, cost $5, as good as new; will exchange for a Cushman, 2 in. or up scroll chuck, or other make; will give a satisfactory trade on the difference in price, if any. Louis Lutz, St. Clair Street, Toledo, O.

I have a lot of "Galaxy" (magazines) which I would like to exchange for an air rifle in good condition, a collection of birds' eggs, or offers. W. B. Greenleaf, 480 La Salle Ave., Chicago, Ill.

I have a Mechanical Telegraph with book of instructions, books, etc., which I wish to exchange for good microscopical objects, mounted on 3 x 1 slips. Address, with list, J. H. Frey, Millersburg, Ohio.

To exchange, "How to Use Microscope," Wells' "Natural Philosophy," and many other books, chemical apparatus, etc., for good photographic camera, and lenses. W. H. Weed, 254 Putnam Ave., Brooklyn, N. Y.

Wanted "Quimby's New Bee Keeping," for "Our Own Birds of the United States," by W. S. Baily; new. Joseph Anthony, Jr., Colota, Whiteside Co., Ill.

Wanted a good book in anatomy, in exchange for a book on chemistry, or for story books. A. G. G., Box 26, Summit, New Jersey.

A German-silver trimmed, patent lined, cocoa flute, cost $4, in good order, for good spy-glass, photo-material, or offers. Ewing McLean, Greencastle, Ind.

I have some fossil shells from the west bank of the Mississippi, to exchange for Indian relics. A. W. S., 187 E. 71st St., N. Y.

I have a magic lantern, Ruby pattern, nearly new, and 5 views; also "Our First Century," bound in leather, cost $7; state what is wanted in exchange. I. N. Spencer, Box. 217, So. Manchester, Conn.

First-class telegraph instrument and attachments, and "Wood's Botany," for bound volumes of periodicals, books, or offers. H. P. Albert, Anderson, Iowa.

Wanted a book on treatment and care of canary, also breeding of same; will give in exchange book named "Market Garden, Flower Garden and Bees," or 40 "Scientific Americans" or "Seaside Libraries;" want also old books. M. J. Mulvihill, Norwalk, Conn.

Coins, minerals, stamps, books, type, fishing tackle (very complete) and fish pole, bronze inkstand, etc., for coins, medals, stamps, war envelopes, old newspapers, and Continental, Colonial and Confederate currency. F. F. Fletcher, 103 Main St., St. Johnsburg, Vt.

Blow-pipe set (cost $10), large illustrated family Bible (cost $7.50), for Wood's Botany, Dana's Geology, or printing press and type. H. W. Noble, Box 134, South Dansville, N. Y.

I have a number of birds' eggs I should like to trade for other birds' eggs; send for list of trading eggs. A. G. G., Box 26, Summit, New Jersey.

The Young Scientist

SCIENCE IS KNOWLEDGE. KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

VOL. VI. NEW YORK, APRIL, 1883. No. 4.

Something About Saws.—III.

BY "OUR NED."

HAVING fairly discussed the methods of filing hand-ripping and cross-cutting saws from an amateur's standpoint, I will now take up the smaller saws. The back-saw, Fig. 1, may be of various lengths and sizes, but in some one of its forms it is indispensible to the amateur wood-worker. The tenon saw, which is about twelve inches in length, is, perhaps, the most useful for the amateur who can only afford one back-saw, but where two saws of this kind can be obtained, one should be fourteen or sixteen inches long, and the other a thin-bladed, dove-tail saw, about eight inches long in the blade and having about eighteen or twenty teeth to the inch. This latter saw should be kept for cutting the shoulders or small tenons, dove-tail work, and making fine joints. As the blade is very thin, it does not require much "set," but care must be taken not to force it through the wood if there is a tendency towards sticking, as a twist or false movement of the hand may spoil the saw, as the blades are very easily buckled, or "kinked."

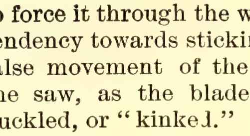


Fig. 1.

Fig. 2 shows the style of teeth required in saws of this kind. The backs of the teeth are left square and the cutting edges filed more or less beveling, according to the hardness of the materials to be cut. If the wood is of a soft kind, such as pine, cedar, poplar or butternut, a little more bevel than is shown in the engraving may be used, but if the wood is hard, such as oak, ash, hickory, walnut or mahogany, then less bevel will answer; but for general purposes, that is, where the saw is intended for cutting all kinds of wood,

soft, medium and hard, the shape of teeth should be as near to those shown as possible.

The larger back-saws are often used for sawing tenons, and therefore have to perform the services of a rip-saw. In hardwood work the ordinary back-saw tooth

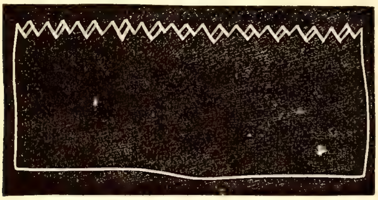


Fig. 2.

will rip pretty fairly, but it does not work so satisfactorily in soft wood; still, in amateur work it will be found better to employ the back-saw for ripping tenons than a rip-saw, as the inexperienced workman will find it so much easier to follow the lines with the former, and, though he may not do the work so rapidly, it will be better done.

If the blade of a back-saw should get slightly "buckled" or crooked, it may be straightened—in a great many cases—by tapping the back gently with a hammer, but care must be taken not to overdo it. A little practice in this matter will soon teach the operator how to obtain the best results.

In the common hand-saw it is necessary that the line of teeth should be continuous or straight to insure the efficient working of the instrument, and this becomes more necessary in a back-saw, for if the teeth are not in line or straight, both on their line of points and on their sides, the saw will make terrible work on fine shoulders, dove-tails, or mitres, the raggedness and tearing of the fibres showing more plainly on fine work than on work done with the coarser saws. Another thing: when the saw is used in a mitre-box, if the teeth are not jointed on the sides with an oil-stone, the projecting points will soon destroy the truth of the mitre cuts, and render it almost impossible to cut a nice clean mitre joint, thus causing a great deal of unnecessary trouble in fitting the joint with a block-plane.

Joints cut with these saws should be good without any repairing; if they do not fit, something is wrong—the saw is out of order or the workmanship is clumsy and careless. In cutting shoulders for tenons, it is always better, when practicable, to rip down the tenons first, leaving the shoulders uncut until the last thing. This saves the shoulders from getting bruised or damaged in any way by falls or with having other stuff thrown against them. A little oil or grease should occasionally be applied to the blades and backs of these saws, to keep them from rusting or getting covered with a sticky film, which is sure to occur if they are only used once in awhile, and then used in pine. Of course, very little oil or grease must be used on the blade, for too much would scrape off in sawing joints and spoil the stuff for gluing, besides discoloring the joint and unfitting that part for taking varnish or polish.

If my amateur friends will again read the papers in the February and March numbers of the YOUNG SCIENTIST on this subject, and connect them with the present paper, I think they will have no difficulty in thoroughly understanding the methods necessary for filing and caring for the three classes of hand-saws discussed, namely—cross-cutting saws, ripping-saws, and back-saws for general purposes; and feeling that this is the case, I leave them now, and will in my next take up a few of the other sorts of saws that amateurs are sometimes obliged to use.

Cheap, Swift and Safe Canoes.

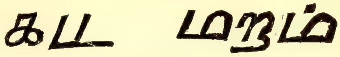
BY W. L. D. O'GRADY.

A WISE man may pick up some things worth knowing almost anywhere. Many of our most wonderful inventions sprang from very humble beginnings. Perhaps I can give a hint or two picked up in India which may add to the enjoyments of the readers of the YOUNG SCIENTIST.

Many boys love sailing, rowing and paddling, all of them manly and healthful exercises, yet cannot afford boats

of their own, and do not like to trespass too often on the good-nature of their friends. Others are kept from the water by their parents or guardians, because boating is often dangerous—always so with ignorance, carelessness or unsuitable vessels.

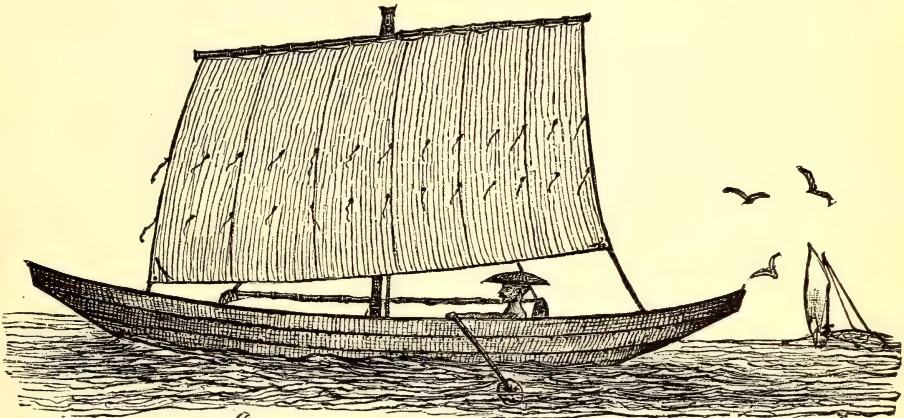
The boat here illustrated (Fig. 1) is of very rude construction, but swift and safe. It can be copied and improved upon as to its appearance very cheaply with the materials at our command. It is not very roomy, but ships less water in the heaviest seaway than a craft of any other model. It is so buoyant that it is impossible to sink it, and, so long as it holds together, cannot be upset. It is easily managed, and will carry thirty grown-up people at a pinch, well squeezed together. It looks something like a spider, but were it not that it takes up so much room on a ship's deck, and when out of water is so practically no better, if as good. (These double canoes, by the way, have no sort of resemblance to the genuine Madras catamaran [or "tied tree" in the Tamil



"Katta" *tied.* "Maram" *tree.*

language], which is made of three logs tied together, the longest in the middle, turned up at the fore-end, with a crew of one, dressed in an extinguisher-shaped cap, in which he carries letters to ships across the terrible surf of the Coromandel coast and any little trifle of tobacco or betel which he wants to keep dry, and not much besides. His paddle is always a piece of broken plank.)

The materials of this Cingalese yacht are wood, bamboo, coir yarn and coir



Cingalese Canoe

Fig. 1.

awkward to handle, could not be equalled as a lifeboat. It is the favorite fishing-boat of Ceylon, the Malabar or western coast of India, the Maldive and Laccadive Islands. It is not unlike, in many respects, the famous flying *phahus* of the Ladrone Islands, first described by Commodore Anson, the circumnavigator, and the latest of our very expensive so-called "catamarans" are indebted to these for their most important feature, and are rope, made from the fibrous husk of cocoanuts. There is not a nail about it. We should probably use cedar for the hull and outrigger, ash for the outrigger poles, and nails instead of coir yarn, and also a little paint or varnish. For the rigging (Fig. 2), coir rope would do as well as any substitute, and can easily be got here. Our sail would be of cotton, nicely made, instead of matting or patched gunnybags sewn together.

The Cingalese yachtsman wears a bamboo ring on his head, which supports a small palmleaf umbrella. We should prefer a hat or cap, and also some more clothing than he usually gets along with.

The keel is a log, pointed at both ends, somewhere about twenty feet long. A trench is cut in this along all its length, except at the ends, to receive the planking of the sides, which are built up, or rather tied together, three or four feet high, with a good shear or rise at stem or stern (which are both alike and sharp); but while one side is built straight, or nearly so, the other has the lines of an

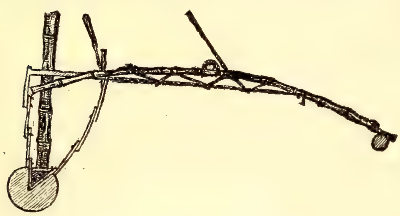


Fig. 2.

ordinary boat, leaving an opening in the middle of hardly more than two feet. From the latter or weather side is extended, at a distance of eight to twelve feet, by bamboo poles, curved so as to keep them out of the water as much as possible, a pole three or four inches in diameter and about ten feet long, pointed at both ends, the whole being loosely but securely fastened together with a multitude of coir yarn and rope lashings, guys and stays. The flat side keeps the boat from drifting to leeward, and the weight of the outrigger keeps it from being capsized, while the displacement is so small and the model is so sharp that it is very speedy. The mast is of bamboo, in the middle, and the single halliard, fastened amidships at the weather gunwale, often does duty as a single shroud. The square sail has two ropes at the lower corners, one fast as a tack and the other flowing as a sheet, and is usually kept on the flat side of the boat, tacking being dispensed with in beating to windward, letting go the one rope used as a tack and hauling in the one used as a sheet, answering the same purpose. Reefing is never thought of in any sort of weather much short of a cyclone, as, if the pressure of wind is

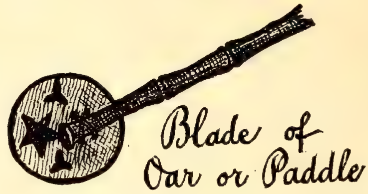


Fig. 3.

heavy, scrambling out on the outrigger gives a tremendous leverage to counteract it. The boat is steered with a paddle or oar (Fig. 3) from either end. The blades are circular, about the size of a dinner-

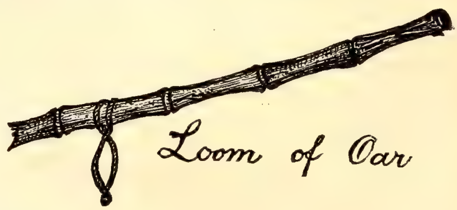


Fig. 4.

plate, and are often adorned with paint. They are fastened to bamboos (Fig. 4) by coir yarn, passed through holes drilled in them. The paddles have a cross handle, (Fig. 5), while the oars, which are rarely over eight feet long, are supplied with a loop of coir rope, which is passed over a single thowl pin (Fig. 6), much resembling that used on the gondolas of Venice, which is usually shipped and unshipped with the oar. They are simply let go whenever the oarsman wants to pull in a fish or fill his pipe without any danger of being lost, and are pulled noise-

Fig. 5.

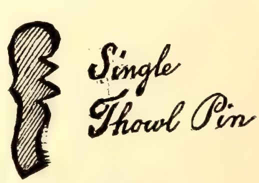


Fig. 6.

lessly, which is sometimes an advantage.

A good imitation of this Asiatic craft could be made, costing not more than twenty dollars anywhere in the United States, and in many places would cost much less. All boys, and girls, too, should be able to swim. Those who can, if reasonably careful, might be trusted by the most timid of relatives in such a canoe, and they would find plenty of fun in holding out a towrope in any weather to most of the high-priced yachts they may fall in with.

Sea Anemones.—II.

BY A. W. ROBERTS.

SOME years ago, becoming greatly interested in the 'dandy' or decorating spider crabs, which are given to ornamenting themselves with bright colored bits of sea-weeds, etc., the idea suggested itself to me to cut up into reasonably small pieces a purple Bermuda anemone, and to slice off from the expanded bases of the brightest colored of the fringed anemones, enough material to supply a small decorating spider-crab that had been hunting in vain for sea-weeds with which to adorn himself. Placing the crab in a sand bottom tank, I confined him in one corner by means of a pane of window glass. In less than an hour's time, after the hashed up anemones had been placed in his compartment, he was hard at work deliberately (and with that peculiarly solemn and grave expression, that all the spider-crabs possess) fastening piece after piece of anemone to his upper shell. As he grasped each piece in his claw he then conveyed it to his mouth where he covered it with a marine glue peculiar to spider-crabs; then slowly but surely he raised it to his back and with a slight downward pressure of the claw he placed it in position. And, so he continued till his entire back was covered with particles of anemones. In the course of three to four weeks he was carrying about with him a vigorous colony of young anemones—and wasn't he a beauty!

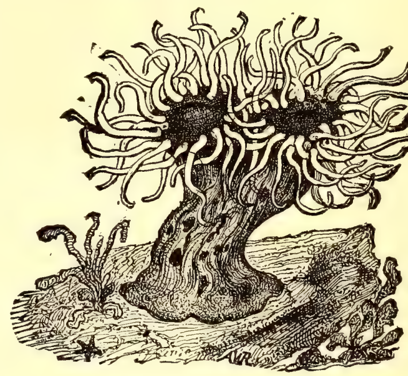


Fig. 1.—Showing anemone with double disk, and food passing into stomach.

On another occasion having an anemone that was very uniquely mottled with brown and pure white, and of which I was very anxious to obtain more specimens of the same kind, I determined to resort to a vigorous system of division from the base of said anemone, by means of a razor, and thus multiply this variety

Fig. 2.—Double-bodied anemone, showing the action of the lasso cells, which are invisible, except under the microscope.

almost to an unlimited number of specimens. In the first place I took the precaution to feed the parent anemone liberally with the fattest of silver shrimps, for

which he had a great liking, so as to always have him in the most robust health. Every morning I applied the keen razor to the extreme outer edge of his base, and so secured from four to five fragments. Did it pain him? No; not in the least. Did he close up suddenly? No. Did he stop taking the gentle shrimp? No. He just went right on attending to his own private, every-day affairs. And as fast as his base grew out again, I relieved him of it; and thus it came to pass that in course of time I had gathered about him a proud family of anemone youngsters just like their papa and mamma, for anemones are both in one.

Fig. 3 represents a section of anemone, showing the inner tube or stomach, and its division by numerous radiating partitions.

To again illustrate the wonderful tenacity of life that these animals possess, I will relate a remarkable example of endurance. When collecting at Cape Cod, Mass., I left by accident some forty or fifty small-sized anemones on one of the long docks. After the expiration of several days, I had occasion to visit this same dock; the anemones were still there, but were very much dried up and parched, so much so that they presented hardly more than what appeared to be a circular stain on the stringpiece of the dock. Still, it occurred to me to peel them off carefully and place them in water, just to ascertain if they still possessed any vitality. Having done so, I forgot all about them for a week's time, and, upon examining them, was greatly surprised to find that fully one-half of the number had survived the ordeal through which they had passed. With all varieties of anemones many interesting freaks of form occur, as for instance, I have had anemones with double and treble disks (Fig. 1), and others with two bodies (Fig. 2) starting from a common base.

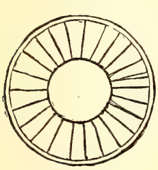


Fig. 3.

In collecting the smaller varieties of anemones great care must be taken, when detaching them from the timbers or rocks on which they have fastened, not to injure or tear through the base, so that any part of the outer wall of the anemone becomes lacerated, or otherwise they will die. The best method is to slowly insert the nail of the thumb under the outer portion or rim of the foot of the anemone, and then, by a persistent and slow pressure, peel the foot away from its attachment.

Fig. 4 shows the "scraper," mentioned in the February issue of the YOUNG SCIENTIST, intended for capturing anemones.

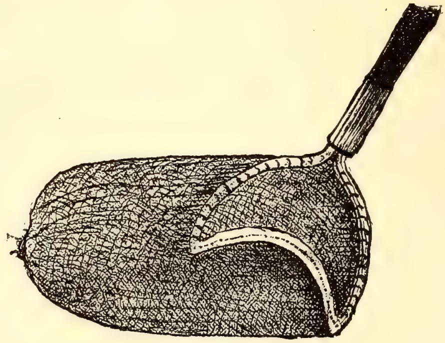
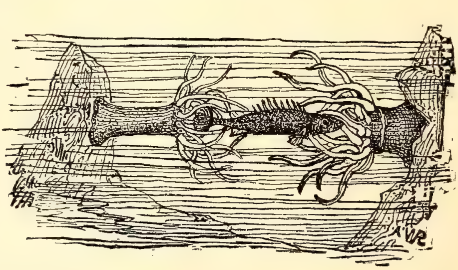


Fig. 4.

It is well for our younger readers to bear in mind that anemones can be sent a great distance by express when packed in what is known as "dry packing." By dry packing is meant placing the anemones between layers of damp rock-weed *(Fucus nodosus)*, from one to two inches in depth. The box in which the anemones are packed should be thoroughly soaked both inside and outside for a few days. This will cause all the joints to swell, and thus make the box air-tight. Some very careful collectors place an inner lining in the box consisting of oiled or rubber-coated paper, which can be obtained of all florists, at little cost.

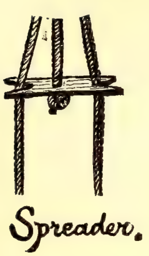


The Mud-Bows of India.

BY W. L. D. O'GRADY.

ARCHERY is a pleasant pastime, but if carried out in all the completeness considered necessary nowadays, is a very expensive one. Much fun can be obtained very cheaply by using a bow and dried balls of clay, instead of arrows. The mud-bow (as it is called) is popular in India. It has two strings, with a patch of cloth connecting them in the middle. With

Fig. 1.



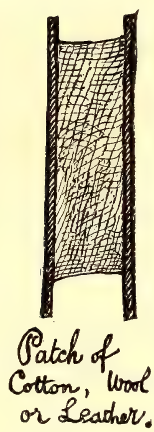


Fig. 3. Fig. 2.

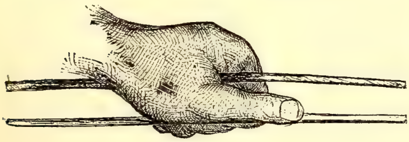


Fig. 4.

Fig. 1. Mud-bow with two strings.

Fig. 2. A patch in the middle, between them.

Fig. 3. Spreaders near each end, to keep the patch from "buckling" or wrinkling up.

Fig. 4. Position of bow when drawn, slightly turned, so as to let the ball pass the thumb. The thumb-nail should be exactly opposite to the centre of the patch.

practice great accuracy may be attained and the missiles can be propelled with force enough to kill small game as far off as a shotgun would reach. Beginners have to be careful, as otherwise they are apt to strike their left thumbs with considerable severity. Idle young officers in India often exercise their skill on peddlers and tramps, and drive them off howling dismally; but this is not a commendable sport. They also use crows as targets, but there is no record of any crow ever having been hit. The Indian crows are wary birds.

A very effective bow could be made here at the cost of ten cents. In India, the regular price of the best manufactured article is half a rupee, about eleven cents. It is not quite as handsome as a lancewood or yew bow, with all its appurtenances. It may be noted that clay balls are cheaper than arrows, and will not stick in people's eyes. They will, however, break glass and kill chickens, if misdirected. They are held between the finger and thumb, at the forepart of the patch, between the strings, and discharged when the bow is bent sufficiently, just like an arrow, on the right side, unless with a left-handed person, the bow being twisted just far enough to the left to allow the ball to pass it. If twisted too far, the ball will go very wide of the mark. With patience and practice the knack is easily learnt. A convenient size for the ball is that of an ordinary marble.

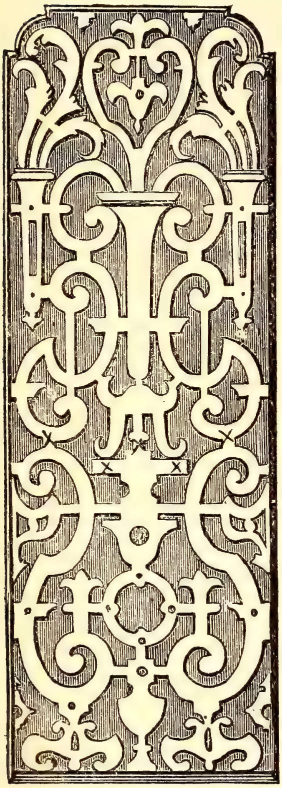
Overlay Work.

ONE of our correspondents asks through our query department for designs of overlay work for small door panels. We herewith publish six different designs intended for the purpose asked.

No. 1 is a very plain pattern, but effective withal, and if cut in light-colored wood—ash, maple or satinwood—and planted in a dark background of mahogany, walnut or teak, it would be very pleasing. No. 2 is a little more elaborate, but would give good results if treated as No. 1.

No. 3 is still more elaborate, and offers opportunities to the amateur carver, as the centre pieces and portions here and there may be carved more or less, according to the skill and taste of the worker.

No. 1.



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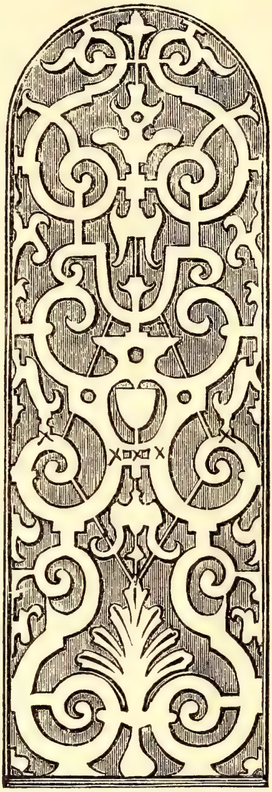

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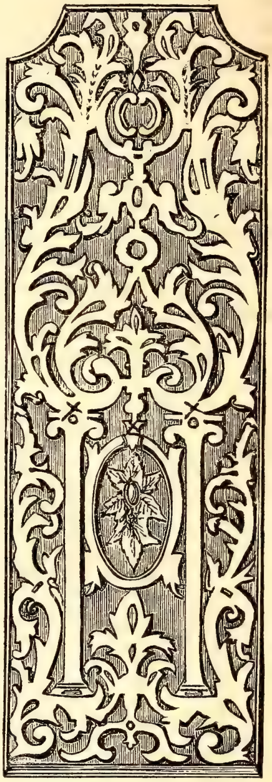

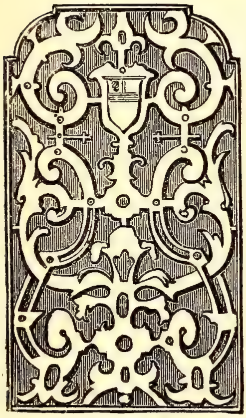

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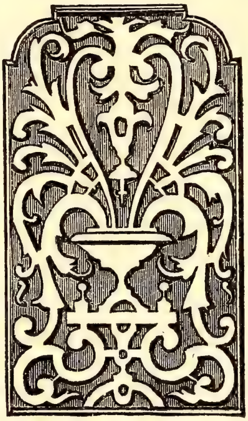
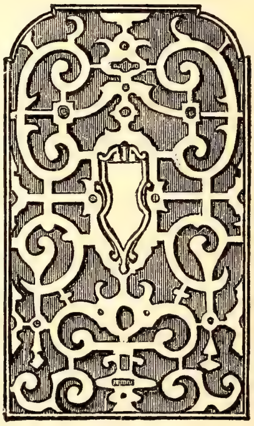


No. 5.



No. 6.

PANELS FOR OVERLAY WORK.

Nos. 4 and 5 are neat and not over-elaborate, and are within the range of most scroll-sawyers. The shield in No. 4 is composed of two thicknesses of stuff. The top piece may be carved and picked in with gold and color, or painted to suit taste. No. 6 is a very graceful piece of fretwork, and is well adapted for the panels or doors of an old-time sideboard. The shield might be a carving—in low relief—of suggestive design—fruit, fish or fowl, or the designs may be painted in low-tone colors.

We have seen fretwork of this kind used on dining-room doors, where the original panels were flat and unrelieved. In this case the fretwork was surrounded by a band of stuff from one-half to one inch in width, and the same thickness as the fretwork or overlay. The work was then fitted in snugly between this frame, and either glued, cemented or bradded on to the panel. The whole was then painted over with suitable color, and, when dry, the fretwork was painted again in a much darker or lighter tint of the same color. The effect is pleasing and comfortable to the eye.

In preparing these designs for special purposes several things must be taken into consideration to produce satisfactory results. First, the sweep of the saw. Some saws will not take in more than sixteen inches in length or width. This would limit the stuff to be cut to something less than two feet in length, if the stuff is twelve or more inches in width. When this is the case, and more length of overlay is wanted than the saw will take in, the design must be made so that it will cut in parts in places where the least number of junctions occur, as *x x x x x*, Nos. 1, 2 and 3. When the designs are sawn out in sections after this manner, the parts may be nicely fitted together before they are fastened in place.

When the panels are long, the designs might be doubled—that is, two pieces of the same design might be used, butt to butt, to fill the panel.

Six pieces of any one of these designs may be cut at once with one of Barnes's $20 velocipede saws, if the stuff is not more than one-quarter of an inch thick.

Overlay work is easily executed, and when judiciously and neatly done, gives good satisfaction for the labor expended.

Amateur Wood-Carving.

BY LEO PARSLEY.

HAVING, in a measure, explained in previous papers the uses of the various tools and appliances required by the amateur wood-carver, I will now proceed to give such directions for their use as will enable the reader to commence operations. It may be readily understood that it is almost impossible to give written instructions for every detail of the wood-carver's art that would be clearly intelligible to every one; I shall therefore give general directions only as to the treatment of the designs, leaving the treatment of small details, such as the number of petals in a rose, or the curl or twist to be given to a leaf, for instance, to the individual taste and skill of the amateur.

The grand secret of success in wood-carving is to obtain a complete command over the tools, so as to make them obey the will of the operator, irrespective of difficulties in the shape of the grain of the wood, etc. To obtain this mastery over the tools, practice is the only remedy, and no matter how simple the design may be, it will be found that continued practice is the only thing to accustom oneself to the use of the tools.

The proper way to hold a carving-tool is to grasp it firmly with the left hand, so that the lower part of the hand comes to within an inch of the edge of the tool, and acts as a guide to it, the right hand grasping the tool by the top of the handle, acts, so to speak, as the motive power.

It will be found that with this method of holding the tool, more power can be exercised, and at the same time there will be less chance of those unlucky slips of the tool which so frequently mar the effect of a piece of work.

There are various methods adopted in carving; some workmen will only slightly "block out" the design in the wood, and

leave the greater part of the work to be done in the finishing. Of course, every piece of wood intended to be carved is subjected to at least two processes, viz., the roughing, or blocking out, and the finishing process. The first thing, then, to be done, after the design has been carefully marked or traced on the wood to be carved, is to cut away all waste or superfluous wood, such as sinking the groundwork of a panel, for instance. When this is done, the outlines and shapes of the leaves, etc., of the design should be roughly shown, and after the design has been thus blocked out, it is advisable to thoroughly sharpen the tools required, and then to carefully finish off every detail. I have, in Fig. 1, given a simple design of ivy-leaves, which may easily be utilized as a panel. We will suppose that the piece of wood intended for the panel has been smoothly planed and squared, and is either oak or walnut and not exceeding half an inch in thickness, and that the design has been drawn on the wood, as at Fig. 1. The work should be firmly fastened down to the work-bench by a carver's bench-screw or other efficient device. A good holder can be made by taking a piece of pine about one and a half inches wide and one inch thick and six inches long; saw out a piece from one end a little less than the thickness of the stuff to be carved, running down the stuff about a half an inch and across the widest way; this will leave a jog or shoulder on the piece; run this shoulder against the edge stuff, letting the upper part overlap. Then screw the piece tight down to the work-bench, and it will hold the work solid. Sometimes it may be necessary to use two or even three of these holders to make the work firm and solid.

Having secured the work firmly to the work-bench, take a parting tool and work it carefully around the *outside* of the outlines of the leaves and stems and *inside* of the panel mouldings, and then with tools of the proper shape and the mallet, set in the lines made with the parting tool. Cut away all the sunken portions of the design (Fig. 1) with hollow tools. The groundwork of the design should be about ¼ or ⅜ of an inch deep, and when this depth is reached the "router" will be found to be the most convenient instrument for regulating the depth. The cutter of the "router" should be set to the depth required, and then by pressing it firmly, and working it sharply backwards and forwards, a level ground will be obtained.

In setting out the outlines of the leaves,

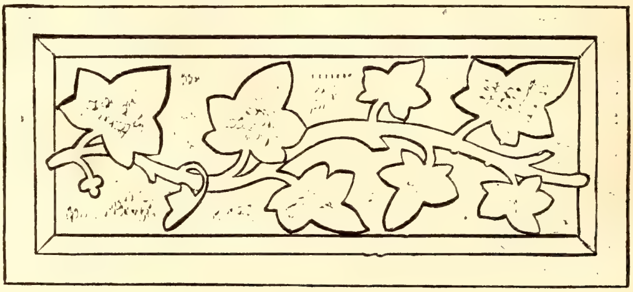


Fig. 1.

etc., it will be better to cut outside the lines, and care should be taken to cut down perpendicular; otherwise, if the leaves are undercut, the shape will be spoiled when they come to be finished. Bent flat tools are used for clearing away the wood when making the groundwork, and for clearing out the wood that cannot be taken out with the "router."

When the groundwork has been so far finished, a commencement should be made in forming the mouldings, and roughly shaping and giving the required turns to the leaves and stem, but no finishing touches should be put on until the whole design has been gone over in this manner.

It is better in doing this to use hollow tools only, leaving the flat tools to finish off the work with. Of course, in setting in the outlines, the tools that are the proper sweep to fit the lines should be used.

When all the design has been carefully gone over, as above described, there re-

mains only the last process to go through, and we begin this by first of all carefully finishing the moulding, which in this case is simply a flat hollow, and then proceed to carefully finish off the leaves and stem, and rectify any little irregularities of the groundwork.

In doing this we shall find the advantage of the frequent use of the hard brush to brush out the small chips and cuttings. When this is done, we commence to use a punch for the groundwork, until it has all been gone over, and then the veins of the

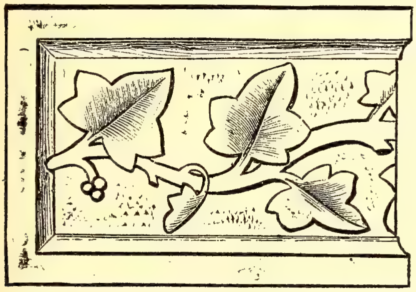


Fig. 2.

leaves require to be put in with a veiner, and the stems require to be roughed, so as to give a natural appearance to the work. The various tools have been previously described, and it will be found

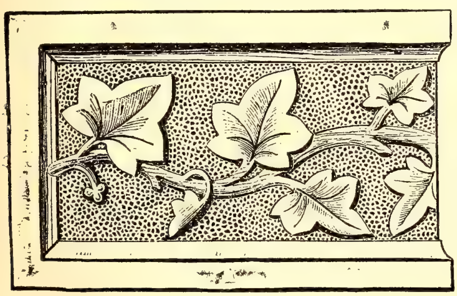


Fig. 3.

that about eighteen will be necessary to work this design. When the work is finished, it may be either brushed over with boiled linseed oil or left plain, as may be desired, but sand-paper, on no account, should be used. Fig. 1 shows the design drawn on the surface, Fig. 2 a part of the design blocked out, and Fig. 3 a portion of the panel completed.

It will be an easy matter, in this design, to continue it to any length. I would advise the amateur to procure a natural leaf of the ivy, and study it closely during his operation on this example.

A School-Boy's "Handy Case."

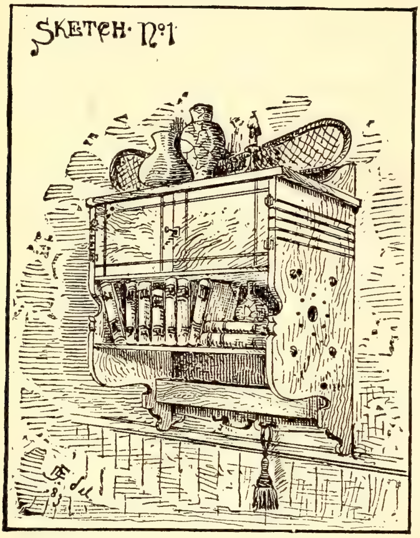
BY EDWARD DEWSON.

THIS simple and useful little case may be put together almost entirely with screws, so as to be readily taken apart if desired, a mode of construction which is termed "knock-down," and is oftentimes very convenient, but requires a little more care in getting out the various parts than does the more common method of "gluing-up."

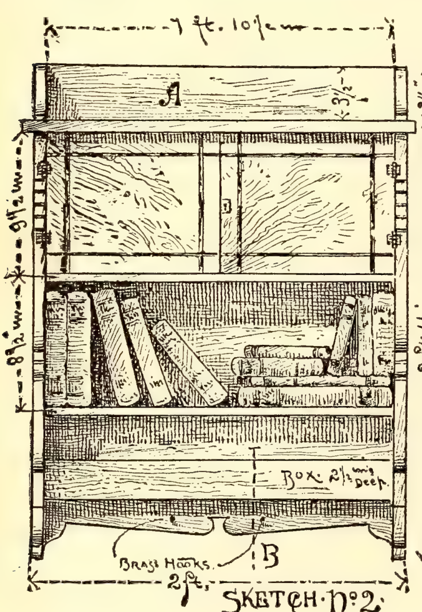
The top space is filled by two doors, lapping one over the other, on a ¼ inch rebate, shutting against the centre partition, and hung with simple brass hinges, allowing the doors to swing entirely clear, for reasons that will be shown shortly. The cupboard partition should be made separately in box form, as shown by Sketch No. 4, of ¼ inch white wood, planed and smoothed down to an even 3-16 inch; follow the measurements, and let them be housed or set into the sides, as shown, and finished with one coat of white shellac, rubbed smooth. This method will be found handy, as the box may be readily removed when the space is wanted for books or larger objects, and be put carefully by for further use. The doors are allowed to swing clear, that this box may slip readily into place.

Below this cupboard is a shelf, allowing an inch clear space for the school-books in constant use, where they may be placed every night, to be readily found in the morning, and so obviate the necessity of hunting the house over at the last moment for a missing book, as is very often the case with school-boys. Below the shelf is a little box 2½ inches deep on the inside, to hold the pencils, tops, marbles and numerous other odds and ends pertaining to boyhood. Make of any good wood, ash or cherry preferred, as being

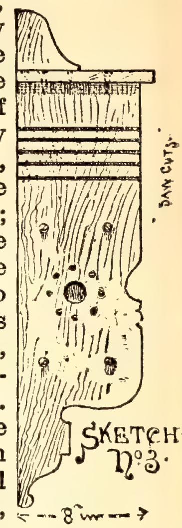
more suitable for this style of work; although if made of good clear pine—avoiding any tool marks—filled and finished

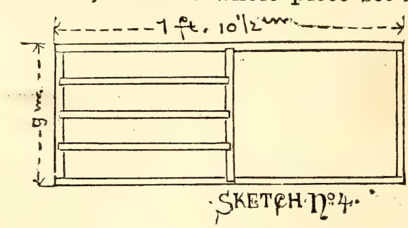


with two good coats of clear white shellac, well rubbed down with fine emery paper,

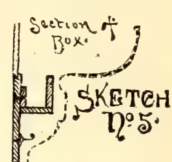


a very neat and pretty case will result. The sides and top shelf are made from ¾ inch stock, each side piece being 8 inches wide; cut outline according to pattern given in Sketch No. 3, which should be carefully enlarged to the full size required. Between the top shelf and bottom of cupboard run five sharply cut saw lines, as shown, and below this cut the simple pattern indicated; this last feature may be cut clean through the stock, if desired. The top shelf is 2 ft. 1½ inches long, and 8¾ inches wide, which allows a ¾ inch projection on front and sides. Shelf is fastened to the side pieces by four 1¼ inch flat top screws; the wall piece, A, on Sketch No. 2, is ¾ inch stock, 1 ft. 10½ in. long and 3½ inches wide, glued between the two small side brackets of same thickness, and the whole piece set into





top shelf with dowels; the bottom bracket, B, on Sketch No. 2, extends up behind the little box, as shown by the section, Sketch No. 5; the back fastens on to this by small screws, and on to bottom of top shelf; this back is ¼ in. white wood, glued up in strips the size required, and should be stained on the inside in imitation of the wood used. If that wood be dark, or simply filled and shellacked, light wood is used.



The ½ inch shelves are rounded on the front edges, and are fastened in place with 1¼ inch silver-headed screws, as shown in sketches. Should grained wood be used, select the prettiest pieces for the

doors; cut the cross lines on surface neatly, finish with a simple brass key-plate over the lock, and be neat and careful in putting the lock in place.

After putting together the case, fill with a good "wood-filler." I would suggest Wheeler's as being good, having used it, although others may be as good or even better. Follow this with a heavy coat of white shellac, which should be allowed to thoroughly harden. Then rub down smooth with emery cloth or good fine sand-paper; repeat this with a thinner coat, and rub lightly till a soft, even finish is obtained.

Sketch No. 1 shows the completed case. As will be seen, two neat brass hooks are suggested at the bottom, the use of which is obvious.

By observing and following carefully directions and drawings as given here, any boy at all handy with tools should be able to put together this little case, which I feel sure he will find useful when completed and put in place in his room.

How to Make a Combination "Shooting" Board for Amateur Work.

THE common shooting board for making square joints, and extremely handy for use in fitting drawer fronts to their respective places, is too well known to need any description whatever. In like manner, it is needless to say anything about the common mitre shooting board, as this is about as familiar as the other. The advantage claimed to be derived from the use of the tool about to be described is, that it combines the usefulness of both square and mitre shooting board in one, and is almost as simply and as easily made as either. A very crude form of this tool is shown by Fig. 1, and consists of two fixed blocks, one at right angles to the long edge of the board on which they are fixed, and the other at an angle of 45 degrees. This simple contrivance is very useful for mitres on small mouldings; but if a piece of wood of any considerable width is required to be shot, the mitre block would be in the way; the width of the board which might be worked on this tool depending altogether upon the distance between the two fixed blocks. What is wanted, then, is a shooting board with a single block that will work both square and mitre joints, and perform either duty equally as well as a separate tool would do. The block must therefore of necessity be a movable one, and there are several methods whereby this desired end may be attained. The best of these

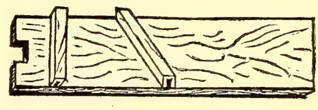


Fig. 1.

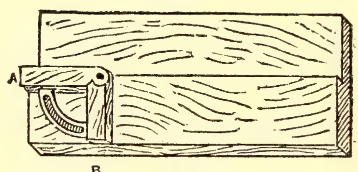


Fig. 2.

methods is, in our estimation, the one indicated by Fig. 2, and which is the tool at present under notice. It is one which, while simple and inexpensive in construction, and quite capable of performing the work both of a mitre and an ordinary shooting board, is yet very easily adjusted, and is one which cannot get out of order. Without any further preface, we will proceed to describe the best method of manufacturing this tool.

Procure a piece of wood about 2 ft. long, 8 in. wide, and 1 in. thick. Plane this up, and upon it glue another piece, 24 in. by 4 in., and ¾ in. thick, so as to form a rebate along one face. If the thicker wood can be obtained, cut a piece 24 in. by 8 in. and 1¾ in. thick, and take the rebate, 4 in. by ¾ in., out of the solid wood. A section of this board is shown by Fig. 3.

Fig. 3.

Fig. 4.

Next cut out two pieces of wood, each 4 in. long by 1¼ in. square. These are to be blocks, one of which is fixed as a guide to the other, which latter is movable. Clean

and cut them to the shape as shown by Fig. 4. The ends of these blocks are mortised and tenoned together somewhat after the same style as a common 2-foot rule is hinged. When this joint has been made, fix one of the blocks on the face of the board which forms the "bed" or foundation of the tool. This block is marked A on Fig. 2. Before putting on the other block, a piece of wood must be cut out, shaped something like a quadrant of a circle. This should be about $\frac{3}{8}$ in. thick, and must be let into and screwed on the under side of the movable arm (Fig. 5). The latter may now be fixed on to the end of the fast block in the manner shown on Fig. 2. This is done by boring a $\frac{1}{4}$ in. hole through the tenons of each block, and then fitting in a plug, so as to allow the block to be moved from side to side. Now put a screw through the slot in the quadrant-shaped piece of wood into the bed of the shooting board, in such a manner as will just allow the arm to be pulled round to an angle of 45 degrees to the long edge of the tool, and will there stop it from going any further by catching the end of the slot in the curved piece. This same screw will also catch the arm when it is put back at a right angle to the board, and prevent it going any further in that direction. Fig. 2, which shows the block placed to allow a square joint being made, and Fig. 6, which shows the arm pulled back in order that a mitre may be shot, will help to make clear any indistinct portions of the preceding description of this tool.

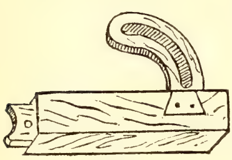


Fig. 5.

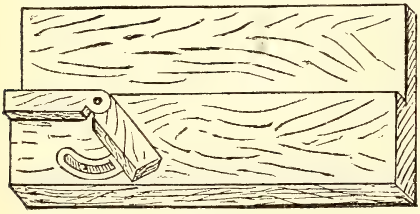


Fig. 6.

Almost any sort of wood will do for the making of this tool, provided it be sound. We have even seen ordinary pine used, but in our opinion this is rather too soft for constant usage, and very soon gets knocked to pieces. However, any sort of hard wood will do, and if made out of mahogany throughout, a really handsome tool is the result.

The total cost of manufacturing such a tool as the one described need not be more than the price of the wood. This will cost about seventy-five cents if made in Spanish mahogany, and about fifteen cents less if made in Honduras.

The Manufacture of Baseball Bats.

BUT few people outside of baseball players have any idea of the great number of bats used in a year. It is estimated that between 4,000,000 and 5,000,000 of these implements were sold during the year 1882. To manufacture these bats nearly 30,000 cords of wood must have been consumed. These are, seemingly, startling figures, but the facts appear to support them. Michigan manufactures more baseball bats than any other State, for in that State the best wood is found. Bats used by professional clubs are now almost invariably made from ash, and even this wood, strong and elastic as it is, must be of the best quality and perfectly seasoned in order to stand the strain put upon it by the baseball players of to-day.

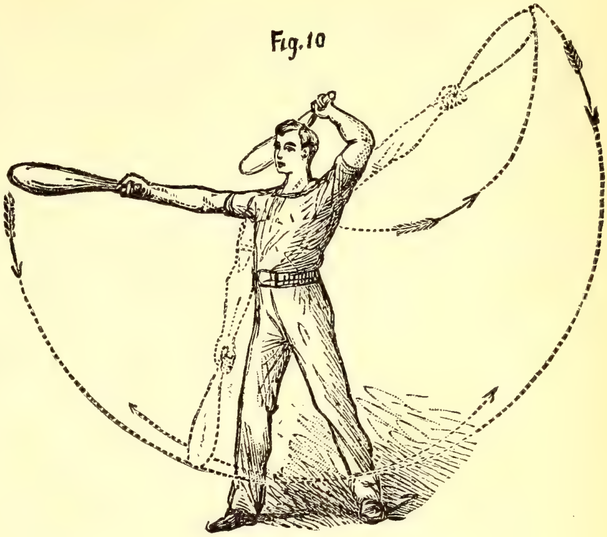
The majority of bats made, however, are intended for amateur players, and are manufactured from American willow.

The willow bats are much lighter than those made from ash, and consequently are much more popular with young players. There are bat manufactories in almost every State of the Union, but the largest and most noted, besides those in Michigan, are in Massachusetts, New York, Rhode Island, Illinois and West Virginia. The bats are turned out by machinery, and, as they are of uniform size and pattern, a lathe and the right kind of timber are the only requirements for a manufactory. Recently orders for bats have been received from European

countries, Australia, and Japan, indicating that the superiority of these goods is becoming known all over the world. Many of the firms manufacturing base-ball bats also produce the wooden implements, balls, and other goods used in the games of cricket, croquet, etc., and it is stated that the demand for the manufacture is much greater than for many years past. As the season for out-door games approaches, the call for all goods made will materially increase, and the producers are preparing to meet the anticipated large volume of trade.

M. C. GRAY.

Fig. 10



Indian Clubs, and the Way to Use Them.—III.

BY JAMES A. SQUIRES.

EXERCISE 8 (Fig. 10).—This is a simple swing backwards and forwards, each club being swung alternately in front of the body and behind the head. When the right club is extended at arm's length, almost straight from the shoulder, the left club is passing behind the head, and *vice versa.*

Exercise 9 (Fig. 11). This is exactly the reverse of Fig. 5. The illustration will show the movement.

Fig. 11

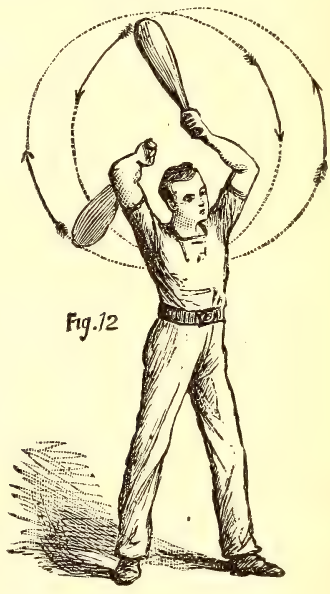


Fig. 12

Exercise 10 (Fig. 12). This is very effective, and if performed rapidly and

neatly is sure to elicit applause from an audience. It consists of circles behind the head with each club, in the direction shown by the arrows, one club passing in a downward direction while the other is swinging up.

Exercise 11 (Fig. 13). This is not very

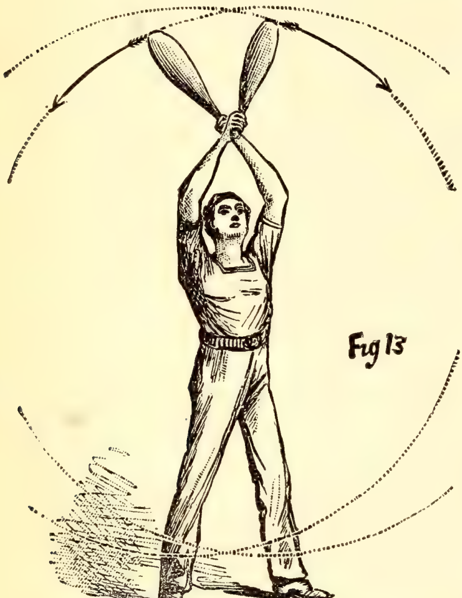
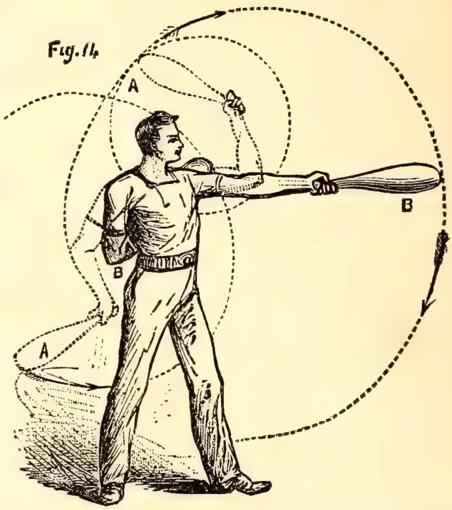


Fig 13

difficult to perform. Keep the arms straight, and beware of a collision. The clubs are swung in a circle across and in front of the body, passing one another twice in their course—once when above the head (as in the figure) and again in front of the legs.

Exercise 12 (Fig. 14).—Now this *is* difficult, and will take a long time to learn. It is a complication of Exercise 3. Commence with that, and, having got the clubs into a good swing, check the course of the right arm, slightly decrease the pace of the left arm, and throw the right club sharply behind the body, until the base rises a little above the left shoulder (see Fig.); then swing it back to A and B, and continue the original circle, all this time keeping the other club (the left) traveling in a circle, until it becomes its turn to effect the movement that the right one has just completed, and so on, first with the right club behind the body, and then with the left in front, and *vice versa*. This is one of the best and prettiest exercises yet described, and will entail long and patient practice; but when

Fig. 14



thoroughly acquired it will well repay the perseverance expended upon it.

Our Birds.

BY C. W.

SPARE moments may be very pleasantly spent in watching the birds. It may be thought that nothing new can be learned about our more common birds, such as the robin or chipping sparrow, but I think that many interesting facts will be noted by any one who gives a little time to their study.

But I hear some one say, "Well, that is all right, but those of us that live in the city don't have much of a chance to watch birds." Now here is just where I disagree with you, for I live in a city and yet in the course of a year I generally fill a good-sized note-book. Among the species that I have noted during the past year, here in the city, are the night-hawk, bluebird, catbird, Baltimore oriole, English sparrow, purple grakle, cow-bunting, brown creeper, crow, kingbird, chipping sparrow, song sparrow, house wren, humming-bird, Phœbe bird, white-bellied not-

hatch, robin, black snowbird, chimney swallow, and yellowbird or goldfinch. Many more have been noted within the city limits (Syracuse, N. Y.) I mention these simply to give some idea of how many birds are to be found in the parks and yards of our cities.

While birds have specific characteristics or habits (i.e., habits common to all the individuals of a species), they also have individual peculiarities. These latter are often the more interesting, and often show something *very much like reasoning power.* To trace the relations of cause and effect in the actions of a bird is both interesting and instructive. Another branch, and one that may be very profitably pursued in connection with the study of their habits, is the study of the general anatomy (if I may so use the word). See how perfectly each part is adapted to its own particular use, and how all are modified in accordance with the food and habits of the species under consideration. Examine the plumage of a chickadee; how fluffy the feathers are, and how well adapted to resist cold. Do you wonder now that the little fellow does not mind the weather? Look at his feet and compare them with those of a vireo; what broad soles both have, and how well adapted for perching.

But do not think that only the habits and formation are to be studied. When you have a good collection of notes at your disposal, you are just ready to take up a new branch of the study—that of collecting and examining the various evidences of reasoning power which you have noted. Begin with some fact and ask yourself the question "Why?" and answer it. Collate all the parallel instances and form your theory. Then, after it is formed, be ever on the watch for facts to support or disprove it. But there is no need of my mentioning the different branches of the study; a few weeks' experience will furnish more suggestions than could be easily enumerated.

Let us next examine the means of study. A gun is indispensable for general field work or for an "ornithologist," but is usually out of the question in the city. The best substitute, and one that is better in many respects, is a field-glass. An ordinary telescope or an opera-glass will do. The use of the field-glass has been minutely discussed recently by a writer in "The Ornithologist and Oologist." Perhaps I can do no better than to quote some of his remarks:—"A bird thoroughly shot with the glass is forever alive and fixed in the mind, and a hundred little ways and habits have been noted, which would have been entirely lost if shot in the usual manner. To know a bird thoroughly it must be watched very closely, and it is often the case that many habits and queer ways are noted before enough of the descriptive points are obtained to determine the species. * * * Having obtained all the points as to size, color, particular markings, etc., with the aid of any good text-book, the species may soon be determined. There are some difficulties in the way, and at first some errors may be made. With the novice the female purple finch might be taken for a sparrow, and the hairy and downy woodpeckers would, perhaps, cause a little trouble, but in a short time nearly all birds will be recognized at first sight. A bird should be studied for color against a dark background; if seen in the face of strong sunlight everything becomes black. * * * Measurements obtained at glass range may be quite easily determined by comparison with the dimensions given in the text-books of some familiar bird like the robin or bluebird. For small birds the chickadee or some familiar sparrow can be taken." I will only add that the note will often be of great help in determining a species. Many use bird-lime and snares, but I have had no experience with the former, and little luck with the latter.

A study closely connected with that of our birds, or rather embraced in their study, is that of birds' eggs. Many, myself among the number, take a peculiar interest in these, but I will leave that subject for another time.

In conclusion I will make a few general suggestions. Always keep a record of the notes you take from day to day; write it out fully and minutely. If you notice a

bird doing something that you have previously noted, don't omit it and say to yourself, "I've put that down," but make a note of it. This is the only way in which you can decide whether you have noted an oddity or not; habits are simply actions repeated. Among the aids to identification I will mention the "local list," and access to a good library. A "local list" is a list of the birds that occur in a given locality, and is generally based on several years' observation in that locality: it helps by narrowing down your circle of search. In nearly every city or village is a public library, where you can find works on ornithology.

The rising generation will furnish our future ornithologists; but my greatest desire is to do what I can to make the study more universal, for none but good results can follow.

Casting in Plaster of Paris.—II.

BY MARK MALLETT.

IT will be well to make some arrangement by which our cast can be hung up. We may bore two holes through the middle of the top rim of the mould, and put a loop of copper wire through them, bending its ends so as to give them a firm hold, and so arranging it that it will be well imbedded when the mould is filled with plaster. We use copper and not iron wire, because the latter would certainly rust, and sooner or later cause the plaster to become discolored and split. The mould is now ready to be filled, that is, we may now proceed to make the actual cast. Had our work been of a more particular nature we should now have used superfine, but we have decided that fine plaster will serve our purpose. Still, whichever it may be, we must be particular to mix it with the greatest care, by the rules already laid down. Clean water must be used. When ready the plaster must be poured into the mould, and the latter gently shaken and moved from side to side, so as to cause the fluid to run into every cranny, and to leave no air bubbles between mould and cast. The bellows may again be used to advantage to blow the plaster well into the under-cuttings. Lose no time till a covering has been given to the whole mould, for the liquid plaster will quickly thicken and begin to set, and it will not then flow into corners and cuttings; go on till you have laid a coating of fine plaster, a quarter of an inch or more in thickness, over every part of the mould, and then back up with coarse till your cast is thick enough. An unpracticed caster should not venture to leave his casts too thin; it is false economy. They must be strong enough to resist the blow of the mallet used in chipping off the mould. The thickness must to a great extent be regulated by the size and nature of the model; for such a one as the present, three-quarters of an inch, in the weakest parts, will suffice.

Almost directly after the mould is filled, you can begin to smooth and trim off the back of the cast, for this you will do most easily whilst the plaster is still soft. By the time that this is done the cast will be hard enough for you to begin chipping away the mould. The cast should be laid on its back on a table or other sufficient support: if it can be placed in a sloping position it will be easier to work at, and the chips will fall away more readily. Your tools must be a mallet and a blunt chisel. The edge of the latter should be ground off round.

The outer mould and its irons will be easily and quickly removed. By a few bold strokes they can be fetched off in a few pieces, for the clay which has been daubed between them and the inner mould will cause the two to part readily. The outer mould being cleared away, we next have to remove the inner mould.

We have now come to the most interesting part of the whole process. No small pleasure can be promised to the operator whilst with the removal of the inner mould he sees his model gradually reappear in a new, solid, and beautifully white material. The inner mould must be chipped off in small pieces, and with great care, lest injury be done to the cast beneath. It is safer to keep the chisel, whilst working, almost at a right angle to the surface. And now the value of the tinted mould will become apparent. The difference of color will enable the operator at once to distinguish between the mould and the surface of the cast, when the latter is reached, and thus all danger of cutting into the latter by mistake will be avoided. If the directions given are followed with care, the inner mould and cast will separate with sufficient ease, though not so freely as the outer and inner moulds had parted.

A clean soft brush may be used to remove chips from the surface, and the bellows will again be found useful to clear out hollows and under-cuttings.

When the mould has been entirely removed, notwithstanding all our care, we can scarcely hope to find the cast wholly free from imperfections. Some projecting part may have been chipped off, there may be holes caused by air bubbles, or others made by chance slips of the chisel.

In the case of a small breakage, the professed moulder sticks on the piece with a little shellac dissolved in spirit, which he keeps by him in a bottle. This is the quickest way of mending. But it may be done quite as effectively and more neatly with a little liquid plaster, mixed thin

For stopping holes of any kind, plaster must be mixed in the ordinary manner, and then "killed;" that is to say, you must allow it partially to set, and then beat it up with a little more water. Without this precaution it would set harder than the surrounding parts of the cast, and be easily distinguished from them in appearance.

In the next paper I shall speak of the few simple tools used in casting, and give a brief description of wax moulding and piece moulding, and the methods to be followed in making elastic moulds, and taking castings from natural objects.

Painting on Silk or Satin.

IT is more prudent to begin painting on satin, as its smooth surface presents fewer difficulties than the texture of silk. The objection to painting on satin is this: the gloss of the surface is exceedingly trying to the eyes; so much so that, during the past two years several professional painters have been compelled to give up decorating any materials except canvas or paper. Therefore, do not face the light while painting; wear a shade—such shades as wood engravers use. You must test the kind of satin to paint on yourself, by trying a sable brush thick with Chinese white on a small sample. If the satin surface is easily moved by your brush, then give that piece up, and paint on a firmer woven kind. It is poor economy to paint on cheap satin. Keep the satin firmly and smoothly stretched on a drawing board or pasteboard with artist thumb tacks, because these tacks make very tiny holes, and have large flat heads. If you are accustomed to the use of oil paints, then begin by squeezing out the tube colors on blotting-paper, because the paper will quickly absorb the oil with which the paint is mixed, and therefore prevent an ugly, greasy stain on the satin. The paint, not the material, is prepared. It may take your painting one week or more before the satin is perfectly dry. This is one objection to painting in oil. The chief advantage is that as dampness will not affect it, rain does not ruin the costume painted with colors. To prepare the silk or satin for painting, simply lay on ox-gall with a brush over the place which your design is to cover. The ox-gall is used to overcome the oily, greasy nature of paint mixed with oil. Use plenty of paint. Choose a bold design. Avoid the embarrassments of Nature's wealth of leaves. Selection, not servile imitation of Nature, is the only broad, enduring, and therefore safe rule, in design. In selecting a design, remember the flowers and leaves must not hide each other. The leaves should not be represented in a mass, because, from the nature of the material on which they are painting, it is impossible to give all those wonderful gradations of color with which a ray of sunlight illuminates the weeds in a country road. Decorative art does not attempt the impossible; its rules simply save you from the blunders committed during the infancy of the human race. Black satin is the easiest to begin on, as far as your design is concerned, because this black background brings out your slightest effort. Black harmonizes colors. At first, aim at only three distinct hues in a leaf: 1st, for general color; 2d, for the shade; 3d, for highest light. By hue is meant such a combination of cinnibar, green and burnt sienna as you would blend with a palette-knife, to represent the leaf of the trailing arbutus, for example. Blend only with your palette-knife on your palette; to make the painting effective, no blending must be attempted on the satin. The same rule applies to silk. Black is the easiest for a beginner. If possible, arrange your design so that the stroke of your brush, in painting will pass parallel to the rib of the silk, and not across the woof of either silk or satin. Silk or satin is most easily painted with water colors, if you have not long experience in painting in oil. As to durability, a dress painted for the wedding garment of a Revolutionary beauty was in a good state of preservation at the Centennial celebration of 1876 at New Haven. The dress was white silk; the design was painted in several shades of blue. There was no minute work; large, bold curves cut the white silk not covered by the blue arabesques, into graceful white forms. Paint, therefore, is a preservative. Silk or satin dresses, if painted properly, may be bequeathed from one generation to another. It will then "pay" to take some trouble to paint a good design. TRACING.—If you are timid about painting at once on the silk, use tracing paper, because lead-pencil marks cannot be rubbed out easily. Go over the paint line left by the tracing paper with thick colors, or paint, mixed with Chinese white. Transparent colors, laid on silk, will run into irregularly ugly shapes. The preparations used on silk to stiffen it and fill up the texture are various. The danger to be avoided is changing the shade of the silk or satin; therefore prepare the paint, not the silk. It is less of

a risk to use no preparation on the silk or satin. When no preparation is used, the first pigment laid on the satin should be a body color, i.e., the paint should completely hide the hue and texture of the satin. For example: vermilion is unchanging red, perhaps the best example of natural body color, and is seen to great advantage in the better class of Japanese and Chinese painting. Use a white sable brush, and charge it with as much color as possible. When dry, you find a smooth, brilliant red, no matter on what shade of satin you have painted. Try the same proceeeding with rose madder, and though the color looked bright when wet from your brush, it dries a dull, nondescript hue. You are not successful, because rose madder (though a beautiful permanent red) is not a body color; therefore give it a body by mixing it with Chinese white. Do not be dismayed when you see that it is impossible to keep the beautiful red color after adding Chinese white. Go on—add more white. Remember that this mixture should be laid on as thickly as the vermilion, in order to produce a perfectly smooth surface on which you may paint. When perfectly dry, pure rose madder, painted over this surface will give you the delicate red you need. Mixing Chinese white with greens causes them to assume a bluish hue. Counteract this by adding yellow, gamboge, yellow ochre, or Indian yellow. White, mixed with any color or hue, is called a tint. It is important you should use Chinese white only, because that is permanent, and white is the foundation of all tints. Use a bone stiletto, ivory paper-knife, horn palette-knife, or wooden brush handle in mixed colors, as many colors are injured by contact with steel. The exception to the general rule of laying on the color as thickly as possible is this: When you wish to give the effect of white flowers in shadow, as the semi-transparent appearance which is the characteristic of many flowers, add water to the Chinese white till it is almost liquid, and by painting this quickly over the satin, the color of the material, showing partly through the thin white, produces a grayish effect of exceeding delicacy and beauty. Colors bought in powder are better adapted than moist or cake water colors for painting on silk and satin, or, indeed, any textile fabric. Powder colors, such as used for wax flowers, are fine enough for you to mix with Chinese white and gum-arabic. Mix by grinding all at once with small glass muller or the bottom of a small glass bottle. The reason that powder colors are used by the French painters of fans is, because there is more body than when the paint is mixed by the machinery of the professional color maker. Vehicles.—No matter how finely you grind powder paints with water, something more must be added to keep the colors from rubbing off as soon as the water has evaporated. Whatever may be successfully used to fix paints is technically termed a vehicle. The difficulty to be looked out for is this: If the satin be neither white nor black, some color has already been used on the texture, which may be affected by some of the vehicles which are easily used on white paper; therefore try a small piece of satin before deciding which vehicle is to be used. Among the vehicles that have been most used in painting on silk are gum-arabic, gum ammoniac, gum tragacanth (so often found in a grandmother's paint-box), starch—domestic—but possessing valuable properties in the preparation of paper, as well as textile fabrics—rice water, flour paste, the white of an egg (the chief size used in mediæval monasteries) and white castile soap. The most useful, with the least deficiencies, is gum-arabic. It should be bought in lump, and not in powder. Dissolve in cold water, strain through a white muslin, and keep in a wide-mouthed bottle (with a cover) by your side while painting. Mix your paints with this, instead of simply water, if you are using moist or cake colors. Gum-arabic is best dissolved fresh each day, because this, like all other gums, contains an acid which acts against the preservative qualities of this gum in a liquid state. If it is inconvenient for you to mix fresh every day, then add a little alcohol to the gum-arabic, or counteract the action of the acid by an alkaline substance, take one scruple of carbonate of ammonia to an ounce of gum, dissolved in three ounces of water; shake the mixture well. The carbonate will purify the gum-arabic, preserve it for long use, and cause the paints to work more smoothly. Gum ammoniac, dissolved in water, forms a milky fluid that dries transparent. No fly or insect of any kind will approach the satin if this gum is used in mixing the paints. And in this respect ammoniac has a great advantage over colors mixed with honey or sugar-water. It also gives a gloss to the colors, and acts somewhat like a varnish over the water colors. Gum tragacanth, dissolved in hot water, is useful when the paint is not to appear glossy. Starch, made as if for household use, and used only when made fresh each day, is a good working vehicle. Rice water is used by the Chinese to mix their colors. It must be remembered that their brilliant imitations are painted on rice-paper. Flour paste, made without lumps, makes a cheap and convenient vehicle for the mixture of colors. The white of an egg is perhaps the most venerable vehicle for paints; the yolk has been used

with yellow and brown paints. White Castile Soap.—Keep a piece by you, and constantly pass your moistened brush over the soap, so as to mix its white body with your cake or moist paints. In conclusion, remember that the paints you have—whether cake or moist colors—may be used on silk or satin; but if you intend painting a dress, or contemplate using very much paint, it is cheaper and quicker to use powder paints. Use only the best paints. Thus far, the English water colors are the best. The Tyrian colors, which are made by a New York firm, are better than many French and German paints for painting in body color. They are superior to other cheap paints. —*Art Interchange.*

Our Girl's Department.

This department is intended exclusively for "Our Girls," and we hope to make it both interesting and instructive, and to this end we ask our young lady readers to assist by contributions, suggestions, or illustrations. There are thousands of little things that can be, and have been, made and done by young ladies, pertaining to decorative art, needle-work, etc., etc., that would be gladly followed but for a want of knowledge on the subject, and we know of no more pleasing task for a lady than that of teaching her younger sisters that which they are anxious to learn, and which may prove of real benefit to them in the future, as well as being useful and interesting for the present. We trust we will have no difficulty in persuading those who have something nice to show or speak of, to make use of this department. Remember, it is open to all, and if you have anything worth knowing suitable for this column, send it along, and we will give it our best attention. Do not be afraid to write because you may fancy your composition is not perfect, or have other scruples of a similar kind. Do the best you can, and leave the rest to the editor of this department, and we are sure you will be pleased with your work.

FIVE great enemies to peace inhabit with us, viz., avarice, ambition, envy, anger, and pride, and if these enemies were to be banished we should infallibly enjoy perpetual peace.—*Petrarch.*

—No cord or cable can draw so forcibly or bind so fast as love can do with a single thread.—*Burton.*

—You remember the fairy who was so good-natured that any weapon aimed at her changed its quality: stones became balls of silk, and arrows became flowers. The moral of the fable is evident. Be but liked and you will not be censured for your failings (if you have any), nor envied for your good fortune.—*Sharp.*

—When the poet Carpani inquired of his friend Haydn how it happened that his church music was always so cheerful, the great composer made a most beautiful reply. "I cannot," he said, "make it otherwise. I write according to the thoughts I feel. When I think upon God my heart is so full of joy that the notes dance and leap, as it were, from my pen, and since God has given me a cheerful heart, it will be pardoned me that I serve Him with a cheerful spirit."

—Yellow silk tapestry is combined very effectively in upholstery with capucine shades in plush.

—Plush is no longer dependent for decoration upon oil paint or embroidery. The latest style is to carry out an unconventional design in bronze paints, the result appearing like work inwrought in relief.

—A fancy is shown for trimming the ends of plush table scarfs with cone-shaped pendants in plush, no two adjacent ones being of the same color, while all repeat or harmonize with the color of the embroidery.

FLORICULTURE FOR GIRLS.

"Roses musky-breathed and drooping daffodilly and silver-leaved lily!"

Who would not court such sweet companionship? I wonder if girls realize half they miss by neglecting to spare a little of their time for the cultivation of flowers? It is the Eve work in the world. No work in itself more delightful, none more healthful, none that gives greater results for the labor expended; yet as a rule, while a maiden will spend hours over fancywork, or some counterfeit presentment of a flower, the few minutes given to plant-tending are thought much of, and the plants dubbed "ungrateful" if they don't flourish tremendously in gratitude for having a little water poured over them and a dead leaf or so picked off.

It may happen, in the autumn, that the house daughter thinks, "I will have a few house-plants this winter," and she thereupon devotes a morning to potting some of the garden plants, gets quite enthusiastic over it, looks with triumph at the end of the day upon her work, and

expects wonderful returns for her trouble. Three weeks later what is the cry? Why, that "these, though fed with careful dirt, are neither green nor sappy." Zeal without knowledge will not go far. What more dreary sight than a sickly plant? It affects me as does the sight of a sickly child: I cannot help feeling that it suffers—that its existence is no pleasure to it. Though I have not made it part of my creed, my instinct is, as was Wordsworth's, "that every flower enjoys the air it breathes," and if it is deprived of air, or its lungs obstructed, must it not suffer accordingly?

Plants call for scientific treatment. What is science but knowledge—you must know your plants before you can manage them—and the fascination of learning the nature and needs of growing things is, that you can learn and learn, and there still be more to know beyond. You learn the rules for treatment of classes, and then for families of plants—but lo! they turn out to be like families of children—(plant nature is much like human-nature)—unthought-of characteristics crop up in unexpected places: some unnoticed difference in its surroundings, some small variation in its conditions, and the plant develops peculiarities for which you have no precedent, and you are forced to study its peculiar needs and minister to its particular tendencies. But, if you learn to love your plants, you will delight in their vagaries, and keenly enjoy every fresh demand they make upon your intelligence.

The distinctive characteristics of different classes of plants—as widely distinct as different nationalities of people—render them the most charming of all aids in house decoration; if you have caught the æsthetic craze, stop to consider this point. Cut flowers are lovely, and their beauties and uses are appreciated, but the individual plant, its marked individuality setting it apart for special places, uses, and occasions, has not been enough considered.

But I would rather you *grow* plants and help create their beauty, than merely enjoy the effect produced by another's efforts. This is not beyond your ability, but success in this is no more an accident than in any other department of science. The more knowledge you bring to your task, the more satisfactory will be the result of your labors. Apply your knowledge with patience. Let occasional failure stimulate, not discourage you. So will you gain a florist's best capital—*experience*. Experimental philosophy for me!

The beginnings of this science are so much more interesting than the beginnings of most. No endless practice of straight lines before you can produce a thing of beauty; no wearisome crawling up countless scales before you can produce sweet harmonies; no tedious technicalities to wade through, no dry dates to master, before you can get at the heart of your subject! Take your botany and some good work on gardening, if you are creditably anxious for exact information, but you will find it all delightful; your living illustrations will put life into every word and phrase in your text-books, and be a constant commentary on the subject-matter of your learned treatises.

Your imagination and reasoning powers as well as patience and perseverance, will be cultivated in your search after knowledge in this direction. Until you have tried, bright-minded girls, you do not know how far this fascinating quest will take you, nor in how many directions it will invite your eager steps. It has been said "A beautiful woman is a liberal educator." Beautiful flowers might almost be called her rivals. Did not the great poet say, as he took a little flower, "root and all," in his hand, "Little flower, but if I could understand what you are, root and all, all in all, I should know what God and man is!"

Suppose some one of you spends your leisure in studying the laws of plant-life (at least, so far as Mother Nature will let you into the beautiful secret); see if you will not soon say, "For me the humblest flower that blows, holds thoughts that lie too deep for tears!" and see if, when the happy Easter season returns, you are not able to express such thoughts in harmonies of form and color as you never could before!

ELLEN M. HOOPER.

THE

Young Scientist.

A Practical Journal for Amateurs.

(With which are incorporated "THE TECHNOLOGIST," "THE INDUSTRIAL MONTHLY," and "HOME ARTS.")

PUBLISHED MONTHLY AT $1.00 *PER YEAR.*

EDITORS.

JOHN PHIN. FRED. T. HODGSON.

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The extraordinary demand which has been made for the "Amateur's Handbook," during the past few weeks, has entirely exhausted the second edition. We will go to press with a new edition in a few days.

Will those of our subscribers who receive two copies of the YOUNG SCIENTIST, kindly hand the duplicate to some friend interested in such matters, and thus perhaps aid us in securing a new subscriber? Remember that every additional name enables us to improve the Journal, so that all have an interest in adding to the number of our subscribers.

It is not uncommon to hear boys and girls complain that they have no time to do this, that, or the other or to play. The very name of play or pleasure has a magical power. That name makes the most toilsome and laborious pastime a delight; while, if it was called work, it would become irksome and oppressive. Boys and girls should have play and enough of it; there is wisdom in proper recreation and diversion—they harden the muscles, expand the chest, and give that rosy hue to the face that betokens cheerfulness, strength, and a freedom from disease that the inactive youth can never enjoy. After a period of study, the young mind should rest, and a period of diversion and play should succeed. One of the drawbacks of our advanced civilization is the continual strain the youthful minds are put to, to fit them for positions they may never fill. To distort the mind by cramming at the expense of the body is unnatural, and can only end in exhanstion sooner or later. Give the boys and girls a sufficiency of good healthy play; let them romp in innocent gaiety. Give them healthy bodies, and true nobleness will surely follow.

We call the attention of our readers to the articles on amateur wood-carving now being published in the YOUNG SCIENTIST, and trust that many of them will be able to follow the instructions given, and profit by them. There is no reason why many of our young readers—boys and girls —may not be able to acquire sufficient expertness in wood-carving to make many things that would have a commercial value of considerable magnitude. In Cincinnati, Philadelphia, and other cities, many young people are engaged in carving ornamental match-stands, cigar-holders, watch-stands, ink-stands, pen-holders, and a hundred other similar articles that readily find a market, if they possess any artistic merit. In Switzerland, thousands of young people find constant and lucrative employment at this work the whole year round, and hundreds of thousands of dollars' worth of the finished work is yearly exported to this country, England, and France, and is known in the "notion trade" as "Swiss carvings." The workmen, or artists, as they should be styled, are allowed to follow their inclination as to the character of subjects they treat; some cut groups of animals, others ornamental caskets, work-boxes, paper-cutters, salad spoons and forks, while others cut the pieces from which still others build the chalets so commonly seen even in this country as parlor ornaments. The tools required for this work are not very expensive; and as a pleasing and useful amusement, the art of wood-carving stands at the head of the list, with

the bare exception, perhaps, of ornamental turning.

We are sure our readers will fully appreciate our efforts this month in placing into their hands so large an amount of new and excellent matter. We have endeavored to cover a wide field of amateur work with sound practical articles, contributed by actual working amateurs, who know of what they speak. The articles on "Saw-filing," "Boys' Book-Case," "Wood-Carving," "Overlay Work," "Amateur's Shooting Board," and "Painting on Silk and Satin," are all reliable articles from reliable sources; and the papers on "Cheap Boats," "Mud-Bows," and "Indian Clubs," are interesting, useful, and, in a measure, practical, while the article on "Casting in Plaster" will be appreciated by many who wish to possess a knowledge of this useful art. Students of natural history will find something new and suggestive in the papers on "Birds" and "Anemones," both of which are written by contributors who speak from observation. Doubtless many of our boy readers will feel interested in the article on "Baseball Bats," as it will give them an idea of how many bats are annually made, where they come from, and where they go to. The Girls' Department is also well filled this month with excellent material, and we particularly direct attention to the article on "Floriculture," which is contributed by a young lady who has had considerable successful experience in this beautiful art. The paper on astronomy for the month of April, prepared by Prof. Berlin H. Wright, cannot fail to interest the greater number of our readers. Prof. Wright possesses the happy knack of being able to make very difficult matters quite clear to youthful capacities, as is shown by the article in the present number, which, though dealing with a rather complicated subject, is made so plain that any ordinary mind may comprehend it. Our illustrations, also, this month, are deserving of more than a passing notice, as the most of them possess a lasting value. Those on Wood-Carving, Overlay, Boys' Book-Case, etc., etc., are purely practical cuts, that may be brought into profitable use at any time, and almost in any place. Taking it altogether, our readers and ourselves have no need to feel ashamed of the present number, and we do not think we are asking too much of our subscribers when we ask them to use their influence in extending our circulation. All have friends, and there can be no more friendly act than that of placing in the hands of another the means whereby he may add to his happiness, knowledge, and future welfare, events which must follow from a continuous reading of the Young Scientist. Every new name added to our list secures for the future a useful member of society, and increases our ability to make the paper still better.

In several offices in New York where architectural and engineering drafting is done, part of the working staff consists of young ladies, who, it seems, acquit themselves to the satisfaction of their employers. There are many cases, it seems to us, where young ladies might be profitably employed in this kind of work, and it does not require much previous experience or knowledge of the use of mathematical instruments to be able to copy drawings or take tracings, and a few months' practice at this work by an intelligent girl fits her for better efforts. In England and Scotland quite a number of girls are employed as draftswomen, and in nearly every case they have given satisfaction. In speaking of this subject a short time since, the London *Engineer* says "that some months ago Messrs. Chapman & Gurney, at Gateshead, determined to make the experiment of making use of female skill in their drafting department, and went to the expense of erecting a special building, so as to give the ladies accommodation quite separate and apart from that of the ordinary draftsmen. The new office is roomy, well ventilated, and decorated with flowers during the summer months, and is approached by a door so placed that the draftswomen need never meet or see the other employees of the firm. Up to the present time five ladies have had occupation, chiefly in tracing plans of steam

winches, boilers, etc., for the shops, and in finishing off drawings of machinery prepared by the draftsmen. The office hours are from 8.45 to 11.45 in the morning, and from 1.15 to 4.45 in the afternoon. So satisfied has the firm been with the result of the experiment that they are now making arrangements for the introduction of more ladies into their various departments." Young ladies are peculiarly adapted for this class of skilled labor, and we have seen excellent original work turned out by a young lady who had devoted several months to the practice and study of drafting.

The Heavens.

BY BERLIN H. WRIGHT.

THE PLANETS.—APRIL, 1883.

Venus and *Mars* are becoming closer companions in their lonely march through desolate regions, where but few stars are visible to the naked eye, and the objects visible with moderate telescopes are quite as rarely met with. Venus, at the beginning of the month, is directly below the λ in Aquarius—see the figure at the upper right-hand corner of the illustration, Fig. 1, which also shows the relative positions of Mars, Venus, the Moon, and principal stars of this region.

All of the stars down to the fifth magnitude, which are in that portion of the ecliptic allotted to the constellation Aquarius, are here charted, from which it will be seen that the λ in the northwest corner of the constellation is the only figure by which it may be readily identified. The region upon the east of the Equinoctial Colure or for a much greater distance eastward is still more barren of prominent stars or figures. It would be very convenient sometimes if a fine star existed at the point where the earth's path intersects the Equinoctial Colure or First Meridian of the Heavens (corresponding to the meridians of Washington or Greenwich upon the earth), and the equator of the heavens. But the best way of locating this point is by aid of the λ and the two second magnitude stars which form the E. side of the Great Square of Pegasus, which lie almost exactly on the Equinoctial Colure, at about the width of the Ecliptic (16°) above the point of intersection.

The bright star Fomalhaut lies directly in a line with Venus and the λ, at about three times their distance apart below.

Venus rises on the 10th at 4h. 3m. morn.; 20th, 3.51 morn., and 30th, 3.40 morn. Mars rises on the 10th at 4h. 34m. morn.; 20th, 4.13 morn., and 30th, 3.52 morn.

The Moon passes Venus on the 4th, being nearly 6° north, and she reaches Mars the next day, passing about the same distance north of him (see cut). Venus passes within less than one-half of a degree of the fourth magnitude star *Lambda Aquarii* on the morning of the 10th, being south of the star.

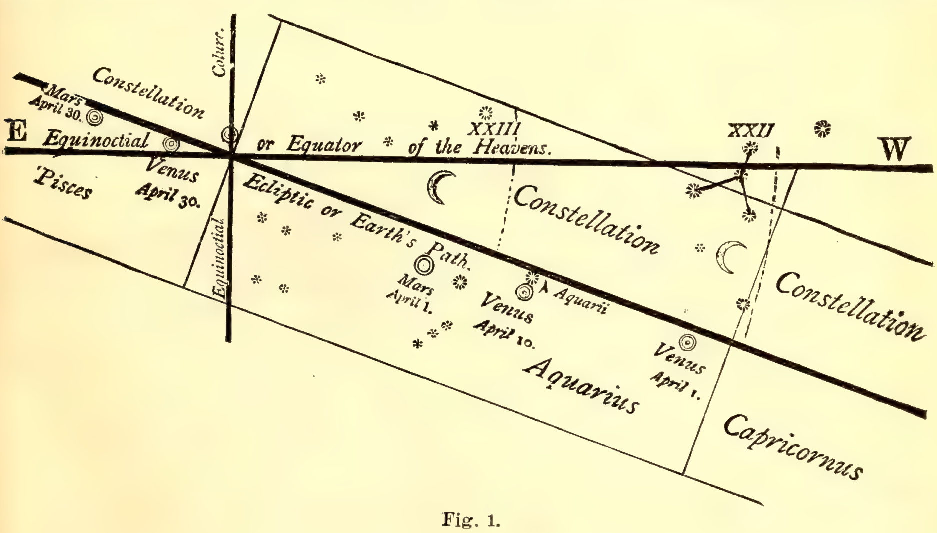


Fig. 1.

Jupiter sets on the 10th at 11.55 eve.; 20th, 11.23 eve.; 30th, 10.52 eve. He will be 4° north of the Moon on the 11th.

JUPITER'S SATELLITES.

Sat.	*D.*	*H.*	*M.*		*Phenomena.*
I.	3	11	17	eve.	Transit, ingress.
I.	4	8	34	"	Occult., disap.
I.	5	8	3	"	Transit, egress.
II.	5	9	23	"	" "
III.	7	8	21	"	Eclipse, disap.
III.	7	11	10	"	" reap.
I.	12	7	45	"	Transit, ingress.
II.	12	9	20	"	" "
I.	12	10	1	"	" egress.
I.	13	8	27	"	Eclipse, reap.
III.	14	7	38	"	Occult., disap.
II.	14	8	50	"	Eclipse, reap.
III.	14	10	30	"	Occult, "
I.	19	9	43	"	Transit, ingress.
I.	20	10	23	"	Eclipse, reap.
I.	27	9	2	"	Occult, disap.
I.	28	8	30	"	Transit, egress.
II.	28	9	15	"	Occult, disap.

Saturn sets on the 10th at 9.18 eve.; 20th, 8.45 eve.; 30th, 8.11 eve. He will be less than 1° south of the Moon on the 9th.

Uranus passes the meridian on the 10th at 10.8 eve.; 20th, 9.28 eve., and 30th at 8.48 eve.

ECLIPSE OF THE MOON, APRIL 22.

The moon will be partially eclipsed on the morning of the 22d. This will be a very small eclipse, as only one-twelfth of the Moon's diameter enters the earth's shadow. The eclipse will not be visible east of the Mississippi Valley, the Moon setting before the eclipse begins. If the full moon should occur at the time the Moon is at her node, then a total eclipse of the Moon must occur, and the further from the node the Moon is at the time of full, provided it is not over 12° from the node, the smaller will be the eclipse.

As the Moon will be approaching her ascending node at the time of the eclipse, it will be apparent from the above diagram that the eclipse will be upon her upper or northern limb. At the next New Moon, or when the Moon is near

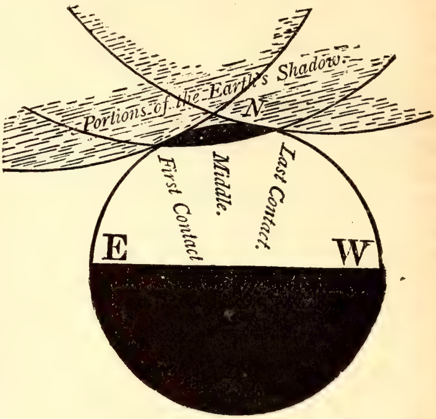


Fig. 3.

DIAGRAM OF THE ECLIPSE OF APRIL 22, 1883.

the descending node at *d* two weeks later, an eclipse of the Sun will occur, of which an account will be given in the YOUNG SCIENTIST.

The earth's shadow first touches the Moon at a point 33° from the north point towards the east, and the last contact occurs 4° from the north point towards the west.

As the Moon passes from west to east through the earth's shadow, the eclipse must begin upon the east side of the Moon.

The Moon will enter the earth's penumbra

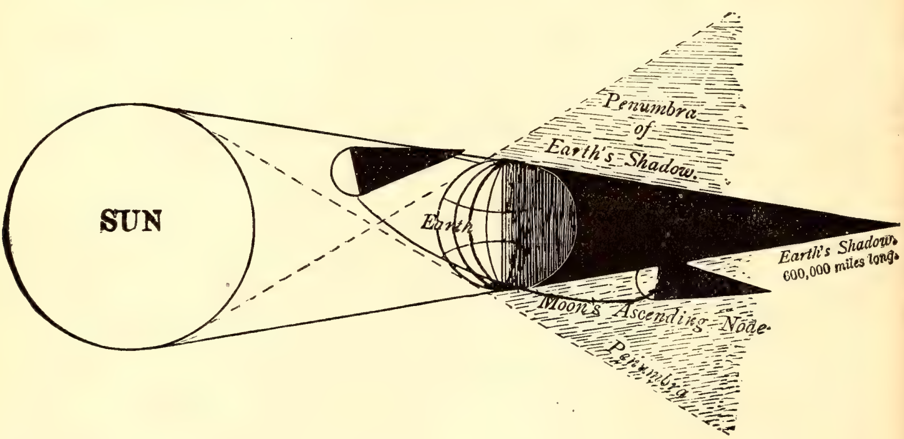


Fig. 2.

SHOWING THE POSITION OF THE MOON AT THE TIME OF THE ECLIPSE OF APRIL 22, 1883.

(see Fig. 2) 1h. 56m. before the time of "beginning," and leave it the same time after "ending," as those times are for contact with the umbra or *dark shadow*.

TABLE OF ECLIPSE OF MOON.

	Begins.		Middle.		Ends.	
	H.	*M.*	*H.*	*M.*	*H.*	*M.*
Chicago,	5	10	5	48	Moon sets with eclipse upon it.	
St. Louis,	5	0	5	38		
New Orleans,	5	1	5	39		
Austin,	4	30	5	8		
Little Rock,	4	52	5	30		
Kansas City,	4	42	5	20		
Omaha,	4	37	5	15	5	51
Sante Fe,	3	57	4	35	5	11
Denver,	4	1	4	39	5	15
Salt Lake City,	3	33	4	11	4	47
Virginia City,	3	33	4	11	4	47
San Francisco,	2	51	3	29	4	5
Portland, Or.,	2	51	3	29	4	5

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS, APRIL 22, 1883.

	H.	*M.*
Alpha Andromeda (Alpheratz) invisible.		
Omicron Ceti (Mira) variable, invisible.		
Beta Persei (Algol) variable, sets	10	7 eve.
Eta Tauri (Alcyone or Light of Pleiades) sets	9	7 "
Alpha Tauri (Aldebaran) sets	9	25 "
Alpha Aurigæ (Capella) rises	4	59 mor.
Beta Orionis (Rigel) sets	8	38 eve.
Alpha Orionis (Betelguese) sets	10	12 "
Alpha Canis Majoris (Sirius or Dog Star) sets	9	39 "
Alpha Canis Minoris (Procyon) sets	11	50 "
Alpha Leonis (Regulus) in merid.	8	0 "
Alpha Virginis (Spica) rises	5	54 "
Alpha Bootis (Arcturus) in merid.	0	12 mor.
Alpha Scorpionis (Antares) rises	10	0 eve.
Alpha Lyrae (Vega) "	7	37 "
Alpha Aquillae (Altair) "	11	13 "
Alpha Cygni (Deneb) "	8	40 "
Alpha Pisces Australis (Fomalhaut) rises	4	52 mor.

Penn Yan, Yates Co., N. Y.

Current Notes.

—The much-ridiculed sunflower is thus praised by a writer in an English journal: "There would, indeed, appear to be but few purposes to which the sunflower cannot be turned with advantage to mankind. Scientifically dealt with, it will supply us alike with our morning roll and our evening cigar. It is equally susceptible of conversion into a cake of soap, surpassingly emollient, or into a rich and lustrous silk dress. As oil it may be consumed no less freely in the salad-bowl than in the table-lamp. Cattle will fatten sooner on sunflower-cake than upon linseed-cake. The little busy bee improves each shining hour more profitably in connection with the girasol than with any other opening flower. In fact, so numerous are its excellences and so beneficial its virtues that the sunflower may with great propriety be designated the friend of man."

—Pernicious stories of the "dime novel" class continue to do their mischievous work. The latest recorded victim was a New London boy, aged fourteen, who shot himself during a period of mental aberration caused by reading dime novels. Parents who hear of such cases and fear for their own boys usually wish that some one would kill the writers and publishers of the vile trash that most boys read when they can get it; but such wishes do not mend matters in the least, for there is no one to do the killing. The only antidote to the dime novel is good reading matter that is not prosy; there is plenty of it in the market, and fathers who do not see that their boys are well furnished with it have only themselves to blame if the youngsters are compelled to find their own literature for want of a paternal supply.—*N. Y. Herald.*

—The Mirage, or *Fata Morgana*, is a very curious but sufficiently common phenomenon, and in the Asiatic and African plains it is frequently observed. When the weather is calm and the ground hot, the Egyptian landscape appears like a lake, and the houses look like islands in the midst of a widely-spread expanse of water. This causes the *mirage*, which is the result of evaporation, while the different temperatures of the air-strata cause an unequal reflection and refraction of light, which give rise to the mirage. Travellers are frequently deceived, but the camels will not quicken their usual speed until they scent water. The Fata Morgana and the inverted images of ships seen at sea are not uncommon on European coasts. Between Sicily and Italy this effect is seen at the Sea of Reggio with fine effect. Palaces, towers, fertile plains, with cattle grazing on them, are seen, with many other terrestrial objects, upon the sea—the palaces of the Fairy Morgana. The inverted images of ships are frequently perceived, and many most extraordinary but perfectly authentic tales have been related concerning the reflection and refraction of persons and objects in the sky and on land, when no human beings nor any of the actual objects were within the range of vision.

Practical Hints.

Violet Stain for Wood.—The wood is treated in a bath made up with 4¼ ounces of olive oil, the same weight of soda ash, and 2½ pints of boiling water. It is then dyed with magenta, to which a corresponding quantity of tin crystals have been added.

Varnishing Paperhangings.—Give two coats of size, 1 lb. of pale glue in 1 gallon of water, should be used for oak and dark color, and when dry varnish with hard oak varnish. For varnishing marble, tiles, and other light papers, use gelatine size and white paper varnish.—*Furniture Gazette.*

Loose Screws.—It is a common thing, when a screw or staple becomes loose, to draw it out, plug up the hole or holes with wood, and then reinsert it. But screws and staples so secured soon come out again. It has been found that a much better way is to fill up the holes tightly with cork. Screws and iron so secured will remain perfectly tight, just as long as when put into new wood.—*Y. S.*

Blackboards.—For imparting a uniform black surface to boards that are to be used as blackboards take of shellac six ounces and of alcohol a pint and a half; warm the alcohol and digest the shellac in it until the latter is dissolved; strain the liquid through a cloth, filter it, and then introduce about five ounces of a mixture of boneblack and emery powder combined in equal parts, stirring the whole together until the ingredients are thoroughly incorporated; the mixture should have the consistency of very thin syrup. Thin, if necessary, with more alcohol, and apply two coats, using a soft, smooth-edged brush.

Metallic Designs on Glass.—An ingenious method of obtaining mirror-like designs on glass has been devised by Leclerc. The glass having been silvered by the chemical process, is coated with a thin and uniform layer of sensitive bitumen, and this is exposed under a transparency, the next step being to wash away the unaltered bitumen with oil of turpentine, so as to leave the bituminous design on the silvered glass. The application of moderately strong nitric acid removes the silver, excepting where it has been protected by the bitumen, so that the metallic design shows like a mirror from the reverse side of the glass. The plate may be backed by paint or any other suitable material.

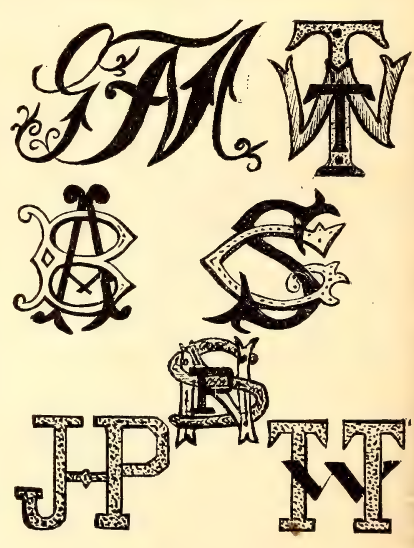
Black Oak.—To turn oak black, so as to cause it to resemble ebony, the wood should be immersed for forty-eight hours in a hot saturated solution of alum, and then brushed over several times with a logwood decoction, prepared as follows: Boil one part of best logwood with ten parts of water; filter through linen, and evaporate at a gentle heat until the volume is reduced one-half. To every quart of this add from ten to fifteen drops of a saturated solution of indigo, completely neutral. After applying this dye to the wood, rub the latter with a saturated and filtered solution of verdigris in hot concentrated acetic acid, and repeat the operation until a black of the desired intensity is obtained. To imitate rosewood, a concentrated solution of hypermanganate of potassa is spread on the surface of the wood and allowed to act until the desired shade is obtained. Five minutes suffice ordinarily to give a deep color. A few trials will indicate the proper proportions. The hypermanganate of potassa is decomposed by the vegetable fibres with the precipitation of brown peroxide of manganese, which the influence of the potassa, at the same time set free, fixes in a durable manner on the fibres. When the action is terminated, the wood is carefully washed with water, dried, and then oiled and polished in the usual manner. The effect produced by this process on several woods is remarkable. On the cherry, especially, it gives a beautiful red color.

Notes and Queries.

In continuing this department, which has been found of so much value, we would remind our readers who wish for information on any of the arts and sciences, that they are cordially invited to make their wants known through this column, and those of them who can furnish accurate answers to questions asked are requested to send in replies. Doubtless many of our subscribers may know of methods, processes, or devices that may be better or more suitable for the particular case in question than anything generally known, and it is this reason that induces us to keep this department open for a medium, where an interchange of ideas and practices may be made to the advantage of all our readers. Correspondents will please send their full address when forwarding their communications—either questions or answers—not for publication, unless expressly so stated, but so that we may know where to find the writer if desirable. Communications should be sent in on or before the first of each month previous to publication, to insure insertion in next issue.

Answers.

41. MONOGRAMS, G. F. M., A. B., and G. S.—We have received monograms of these initials from several sources. A number of them came too



late for this issue, and others did not possess sufficient merit for publication. We are pleased to find so many young people take an interest in

this matter who have ability to place on paper their ideas of what combinations of letters ought to be. It is impossible to publish everything sent to us, but we hope our young readers will not feel aggrieved if they do not see the result of their efforts appear. It is not because we do not appreciate their efforts that they do not appear in print, but simply because we have not space at our command to accommodate all that is sent us. This, however, should not discourage our young people from sending in their contributions, as everything sent us is a clear gain to them in practice and experience, and by continually "pegging" away, they will be sure to accomplish something before a great while that will compel us to recognize their efforts. The illustration shows the monograms sent.

The monograms J. H. P., T. W. T., and N. S. P., were sent us too late for the March number, and are in compliance to requests made in February YOUNG SCIENTIST.

42. INLAID MONOGRAM.—I herewith send you a design for an inlaid monogram, for E. B.'s consideration. I think it fully complies with the conditions of his request. It may be cut with either a Challenge, Dexter, or a Barnes scroll-saw. I would suggest that the background of the inlay or body of the box be made of walnut, and the inlay of rock-maple; or the box might be made of rock-maple, and the inlay of amaranth or mahogany. If ebony is used for the body of the box, the inlay should be of ivory, which may

be very easily cut, if care is taken while sawing to not feed too rapidly. A mahogany background would look very well with brass inlay, which is almost as easily cut as ivory. If E. B. can afford it, however, I would advise him to get fine rosewood for the body of his box, and inlay it with silver. The rosewood may be veneer, glued on a pine or whitewood base; then the silver need be no thicker than the veneering. I shall be pleased to give E. B. any further information I possess on this subject, if he desires it.—BOSTONIAN.

43. OVERLAY DESIGNS.—"Bostonian" sends us six designs for overlay work for panels, etc., which we publish on page 108 of the present issue, along with description and instructions for making.

44. COLOR LANGUAGE.—(1) Properly speaking, there is no color language. Colors are simply considered as expressions of sentiment when used for that purpose, and are defined as follows: Blue means love: Violet, friendship; a bouquet of violets, therefore, if received from a lady, means that no love is to be expected, but friendship only. Red means ambition; Indigo Blue, the spirit of rivalry; Green, the love of change—fickleness; receiving a love-letter on pale green paper, or sealed with a green wafer or sealing-wax, means that the love-match is to be broken off. Yellow is the color of paternity and maternity, under the pretext that it is the yellow ray of the spectrum which causes germs to develop. So much for the colors of the spectrum. In regard to other colors, black means favoritism; White, unity—universality; Gray, power; Silver Gray or Bluish Gray, feeble love; Lilac or Lavender, feeble friendship; Brown, prudery; Pink, modesty; Pale Pink, false shame. (2) The type-writer is a machine for printing with movable type. The first patent in the United States for a practical machine of the kind was issued in 1868. The types were arranged in parallel rows, and the impression given by the striker or plunger, the operator having but to depress keys arranged with reference to rapidity of motion in the necessary order. In other type-writers the printing types are placed on the periphery of a wheel, and brought to the printing point by revolution. In most varieties the types are at the end of levers, so arranged as to strike at a common printing point, and the paper is passed under that point by ordinary clockwork machinery.

45. PAINTING ON SATIN.—We refer you to an article on this subject in the present number, on page 119. We are indebted to the *Art Interchange* for this paper, which we think is almost exhaustive on this question.

46. REVENUE MARINE SERVICE.—To obtain an appointment as a cadet in the Revenue Marine Service candidates are obliged to undergo a severe examination. The candidate's age must be between eighteen and twenty-five years, and no person will be appointed under any circumstances whose age is not within these limits. He must furnish satisfactory evidence that he is of good moral character, and of sober and correct habits. He is then required to pass an examination as to his physical qualifications, which is made by a board of medical officers from the Marine Hospital Service, who are designated by the Secretary of the Treasury. If the candidate is found to be of vigorous constitution, physically sound, and not less than five feet in stature, he is subjected to a written examination in reading, writing, spelling, arithmetic, algebra, geography, history and grammar, before a board of officers also designated by the Secretary of the Treasury. A standard of proficiency is fixed by this board, and if the candidate falls below this standard, he will be rejected. He will be allowed, however, a second examination at the next annual convening of the Board of Examiners, and if he fails in this examination also, his rejection will be final. Candidates who attain the required standard in both the physical and mental examinations will be eligible for appointment, and will be placed upon a list in the order of proficiency exhibited in their examination. From this list names will be taken in regular order for appointments to fill existing vacancies, such as may occur before the class for the year is made up. Passing the required examination does not guarantee a candidate's appointment, however, as the list is not likely to be exhausted in making up the class. In the physical examination special attention is given to the visual powers of the candidate, and more particularly to color-blindness and the defects in acuteness of vision. The academical examination is in arithmetic, in notation and numeration, compound numbers, properties of numbers, fractions, ratio and proportion, percentage, interest, discount, mensuration and evolution; in algebra, to equations of the second degree; the whole English grammar; the history of the United States; a theme upon given subjects as a test of penmanship and composition; a written exercise in spelling, and a general acquaintance with the geography of the world.

47. HUMAN BONES.—According to Brande there are 260 distinct bones in the human skeleton, counting everything. An excellent authority—Willard Parker—in Johnson's Cyclopedia, says: "The entire skeleton of the adult consists of 204 distinct bones; if the teeth and certain accessory bones, termed sessamoid, are included, the number is 246." The difference in these statements rests in the fact that what some persons term bones, others do not. It is generally understood,

however, that there are 246 distinct bones in the human body.

48. POTTERY.—In reply to "Quiner," we may say that it is impossible to do this subject justice in this department, and the best we can do is to give a few hints and recipes here, and a promise that the subject shall receive our attention at length in future numbers. Should the following be found useful to "Quiner," we may return to the subject again here:

In enamelling articles of pottery and glass, the colors are prepared principally from the oxides of different metals melted with a vitreous flux, well ground for use in an essential oil, and in enamel painting laid on with a camel-hair pencil, the fire of the enamel kiln fusing the colors so that they adhere to the glaze. The principal colors are oxides of lead, platinum, chromium, uranium, etc., etc. Oxides of tin and antimony give opacity.

Manuscript books of recipes are very imperfect. Managers of works having had no scientific education, are not to be trusted when dealing with this branch of pottery.

Of "dips," something useful may be found in the following:

Purple Dip.—40 quarts of blue clay slip, 1 oz. calx blue, well ground, 2 ozs. manganese.

Blue Dip.—50 quarts blue clay slip. 1 oz. calx blue.

Red Sponge Dip.—4 quarts red slip, 2 quarts white slip, 1 lb. steel filings, 1 lb. lead ore.

Green Dip.—5 quarts cane slip, 5 ozs. ground zaffre, 1 oz. copper scales.

Another.—1 quart blue clay slip, 1½ oz. ground nickel.

White Dip.—6 quarts blue clay slip, 1 lb. steel filings, 1 lb. lead ore.

Olive Green Dip.—12 quarts cane slip, ½ oz. zaffre, well ground, 2 ozs. copper scales.

Olive Dip.—1 quart black marl slip, 2 quarts blue clay slip, 2 ozs. zaffre.

Another Blue Dip, said to be "very good."—4 lbs. Cornwall stone, 1 lb. Cornwall clay, 3 pints bone slip, 3 pints blue clay slip, 10 ozs. cobalt blue. Fluxed liquid.

Flux for Blue Edging, etc.—4 lbs. flint glass, 1 of blue calx, 2 ozs. nitre, 2 ozs. borax.

Queries.

49. IDA, Phila., Pa.—If Miss H., or some other well-informed person, will give a few hints on the cultivation of parlor plants, and describe what plants are the best to nurture, a great kindness will be conferred on a life-long invalid.

50. KATIE B., Rochester, N. Y.—I am in want of a recipe for cleaning kid gloves, one that has been tried by some of your "girl" readers who have been successful. I do not want any of the methods that are written in some of the cheap receipt books, as I have never been able to make a success of the work by doing it according as it is described in those books. What I want is a real practical, common-sense process, that any girl of fifteen can follow. Now, girls, which of you is going to send the best recipe?

51. BIG BOY, Utica, N. Y.—Having tried my hand on amateur woodwork, with pretty satisfactory results—at least my friends say my work is nearly as good as if done by a professional—it is now in order for me to attempt the operation of staining, varnishing, and polishing; and as many other "Big Boys" besides myself may wish to acquire some knowledge of the processes, I make bold to ask you to publish a few recipes for this kind of work, and oblige an earnest student.

52. AMATEUR, Newark, N. J.—I have a small grindstone that has been in use quite a long time and is worn away much more at one point than at others, and in consequence I find it very troublesome in grinding my tools, when such operation is necessary. Can you or any brother reader tell me if this trouble can be removed, or will I have to purchase a new stone?

53. MONOGRAMS.—The requests this month for monograms are more numerous than for previous months, and we fear we shall not be able to afford space for illustrating more than about one-quarter of them. The following are some of the combinations asked for: E. S. G., plain; T. M. G., rustic; L. L. L., ornamental; A. L. L., neat and plain; A. C., no directions; A. T., V. A., and C. H. We have a number of other combinations asked for, but we cannot find space for more than those mentioned above.

54. MONOGRAMS.—Bella S., Detroit, asks "why we do not publish some monograms suitable for embroidery work, such as are used for the corners of napkins, handkerchiefs, and similar articles?" Well, Miss Bella, we shall be pleased to publish any suitable designs that we may receive for the purpose, and hope some of our lady readers will take the matter up, and furnish us with a number of designs for needlework.

55. NELLIE D., Denver, Col.—Last summer I was East, and saw quite a number of needle-cases made by using two shells, some fine flannel and ribbon. I have a number of shells, and shall be pleased to have some information as to the manner of making the cases, if some of your lady readers will kindly impart it.

56. H. A. K., Kansas.—How can I make a small electric light apparatus? What do you think of the new portable electric light made in Boston? Is it a good thing?

NOTE.—It is rather difficult to make a small electric light apparatus that is good for anything. The Grove or Bunsen battery, about 30 cells, would probably be the most convenient. It was this form that was used by scientific lecturers before the days of the dynamo apparatus. We have not seen the Boston light, and cannot express an opinion, but as we understand it, it is used chiefly for lighting gas, not for giving a light. You will notice that the advertisement reads, "Portable Electric Lighter."

Market Report.

Retail Prices.

IMPORTED CAGE BIRDS.

Canaries, *Belgian*, per pair	$6.00 to 15.00
" *French*, each	6.00 to 15.00
" *German, Hartz Mts.*, each	2.50 to 10.00
Gold Finches, each	1.50
Gold Finch (mules), each	2.50 to 5.00
Bull Finches, each	2.50
Bull Finches (tuned), each	10.00 to 40.00
African Finches, per pair	2.50 to 5.00
Chaffinches, each	1.50
Linnets, each	1.50 to 2.00
Linnets (mules), each	2.50 to 5.00
Green Linnets, each	1.50
Java Sparrows (blue), each	1.50
Java Sparrows (white), per pair	4.00 to 6.00
English Sparrows, per pair	1.00
Siskins, each	1.00
Gray Cardinal, each	4.00 to 5.00
Nightingales, each	8.00 to 25.00
Japanese Nightingales, each	5.00 to 10.00
Thrushes, each	5.00
Skylarks, each	5.00
Troopials, each	7.00 to 12.00
European blackbirds, each	5.00
Black-caps, each	4.00
Starlings, each	4.00 to 6.00
Ring Doves, each	2.50 to 3.00

AMERICAN CAGE BIRDS.

Canaries, each	2.50
Mocking Birds, females, each	1.00
" " singers	12.00
Robins	2.50 to 5.00
Blue Birds ("Blue Robins") each	1.50 to 2.00
Indigo Birds, each	1.00
Nonpariel, each	1.50 to 2.00
Virginia Cardinal, each	3.00
Bobolinks, each	1.50 to 2.00
Yellow Birds, each	1.50 to 2.00

QUADRUPEDS.

Terriers, *black and tan*, each	5.00 to 30 00
Terriers, *Scotch and Skye*, each	5.00 to 30.00
Newfoundland Pups, each	10.00 to 15.00
Pomeranian or Spitz "	5.00 to 15.00
Greyhounds, *English*, "	10.00 to 25.00
Greyounds, *Italian*, "	10.00 to 30.00
Guinea-Pigs, *common*, per pair	1.50
" " " " large	1.50 to 3.00
Guinea-Pigs, *all white*, "	2.00 to 4.00
Squirrels, *gray*, "	5.00
Squirrels, *all white* "	15.00 to 25.00
Squirrels, *flying* "	3.00 to 4.00
Squirrels, *small red* "	2.00
Rabbits, *common*, per pair	1.00 to 2.50
Rabbits, *fancy breed*, according to age and purity of breed, per pair	3.00 to 15.00
Ferrets, *English*, "	15.00
Raccoons, each	4.00 to 5.00
Cats, *Maltese* (males), each	5.00
" " (females), each	3.00
Cats, *Albinos, pink or blue eyes*, each	3.00 to 5.00
Rats, *white China, pink eyes*, per pair	1.50
Rats, *piebald*, per pair	1.50
Mice, *white, pink eyes*, per pair	0.50
Mice, *piebald*, per pair	0.50

Prices Paid for Pet Stock by Dealers.

Guinea-Pigs, per pair	$0.40 to 0.75
Squirrels, *gray*, each	0.50 to 1.00
Squirrels, *flying*, per pair	0.25 to 0.50
White mice, per pair	0.15 to 0.20

MARINE AQUARIA STOCK.

Fringed Sea Anemone, Medium-sized specimens	1.50
White-Armed Anemone	0.50
Small Orange "	0.10
Buccinum Snails, per dozen	0.25
Small Crabs, each	0.25
Silver Shrimp, each	0.10
Small Hermit Crabs, each	0.15
Small Spider Crabs (decorating)	0.15
Barnacles, each	0.15
Sheepshead Lebia	0.25
Killie " "	0 10
Eels, "	0.10
Serpulæ, per mass	0.75
Edible Mussels, per mass	0.25
Mussels, edible, per mass	0.25
Sea Cucumbers	1.00
Sertularia	0.25 to 0.50

ALGÆ "SEA-WEEDS."

Ulva, per mass	0.25 to 0.50
Solaria, "	0.25 to 0.50

FRESH WATER AQUARIA STOCK.

FRESH-WATER STOCK.

Stickle Backs, Nest-building, per pair 0.30

Plants, per bunch	0.15	Small Turtles, per pair.	0.25
Shells, per quart	0.50	Snails, per dozen	0.20
Small Dip-Nets	0.50	Frogs, each	0.25
Aquaria Cement 1lb. box	0.30	Fresh-Water Mussels	0.10

Valisneria Spiralis, per bunch	0.25	For the Microscope and Fresh Water Aquarium.
Nitella-Flexilis, "	0.25	
Anacharis, "	0.25	
Ball Plant (Utricularia)	0.25	

Small Rock-Fish, Sun-Fish, Dace, Cat-Fish, Tadpoles, Eels, Lizards, each 0.10

Gold-Fish	0.25	These are all varieties of the golden carp or gold-fish.
Pearl-Fish	0.25	
Silver-Fish	0 25	
Japanese King-gio	2.00	

SEMI-AQUATIC PLANTS FOR ORNAMENTATION OF PONDS, LAKES, AQUARIA AND FOUNTAINS.

White Water-Lily, per root	0.25
Yellow " "	0.25
Arrowhead Lily, 6 bulbs	0.25
Pitcher-Plants, per root	0.25
Fresh-Water Cattails, per root	0.25
Giant Rush " "	0.25
Floating Heart (Limnantheum), per root	0.25
Calamus (sweet-flag), per root	0.25
Water-Cress, cuttings	0.25
Jack-in-the-Pulpit, 6 bulbs	0.25
Lobelia Cardinalis	0.25
Large, Showy Blue Lobelia	0.25
Water Violet (very curious)	0.25

Prices Paid by Dealers.

At this season of the year all stock for aquaria brings a high price.

Aquarium fish (*now scarce*) per hundred	1.50 to 2.00
Gold Fish (*now scarce*) per hundred	8.00 to 10.00
Aquarium Plants (*now scarce*) per hundred bunches	5.00

SHELLS.

Collections of small "cabinet" shells for schools, private cabinets, range from $5.00 to $50.00.

Mother-of-pearl shells, for painting, 75 cts. to $1.50.

Single specimens of cabinet shells range from 25 cts. each to $3.00.

Masses of corals, 50 cts. to $3.00.

Green snail and cowry, with the Lord's Prayer engraved on them, 50 cts. to $2.50 each.

Conch shells, for mantels or hearthstone ornaments: West India Conch, 25 cts.; East India Yellow Helmet, $1.00 to $2.50; Bahama Black Helmet, 50 cts. to $1.50; Bahama Hatchet Helmet, 50 cts. to $1.25. These shells are also for cameo engraving. Zanzibar Cameo, 25 cts. to $1.00.

Ground and polished shells: New Zealand Green Ear, 50 to 75 cts.; New Zealand White Ear, 50 to 75 cts.; Japan Black Ear, 50 cts. to $1.00; California Red Ear, 75 cts. to $1.25.

Fine shells for fancy work, according to colors and variety, per quart, $1.00 and up.

Fancy Wood for Scroll Sawing.

The prices given for the various woods used in this work are for the best of qualities of seasoned material, planed on both sides, ready for immediate use. They can be furnished in quantities to suit purchasers. Prices are by the square foot, and vary according to thickness of material.

DESCRIPTION.		THICKNESS. 1-8	3-16	1-4
Black Walnut	Per Ft.	7	8	10
White Holly	"	10	12	14
Oak or Ash	"	8	10	12
Mahogany	"	10	12	14
Red Cedar	"	10	12	14
Rosewood	"	18	20	25
Satinwood	"	25	30	35
Birds'-Eye Maple	"	15	18	20
Tulip	"	30	40	50
Ebony	"	50	60	70
Cocobola	"	20	25	30
Amaranth	"	20	22	25

BEST IMPORTED SAW BLADES. 5 INCHES LONG.

Sizes to No. 6, per dozen	10c
" " " gross	$1.co
" No. 7 and 8, per dozen	15c
" " " " gross	1.25
" No. 8 and 10, " dozen	20c
" " " " gross	1.50

For all information on this subject, as to reliable dealers, etc., etc., send postal card to YOUNG SCIENTIST, When desired, the goods can be sent through this office, but in all cases remittances must accompany the order.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business matter in letters or cards they are filed away and never reach the printer.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

"Crystallography" (40c.); "Electricity" (40c.); "Selection and Use of Microscope," abridged, (30c.) Either in exchange for "Workshop Companion," or two for "The Microscope," by Ross, or offers. C. H. Denniston, Pulteney, N. Y.

A printing-press, chase 5½ by 7 inches, in good order; will exchange for a large self-inking press or type. A. W. Barrett, Canajoharie, N. Y.

Home Medical Battery, cost $7; Lemair's Field-Glass, No. 2202 of Queen's Catalogue, cost $15.50; Achromatic Spy-Glass, power 25 times. To exchange for books or offers. Emerson Heilman, Heilmandale, Pa.

Silver watch, key-winder and Home Works, for good microscope or offers. Wm. Hodgson, 128 Mangin St., New York City.

A small collection of coleoptera, comprising 100 species and 300 specimens, all correctly named, in exchange for bird-skins, insects, books, or eggs. Emil Laurent, 621 Marshall St., Phila., Pa.

A small magic lantern, Ruby pattern, with twelve slides, for a good book on Entomology, with illustrations. Willie R. Hotchkiss, Morrisdale Mines, Clearfield Co., Pa.

Wanted, Thompson's "Witchery of Archery." Must be in good condition. Write before you send. J. Anthony, Jr., Coleta, Whiteside Co., Illinois.

A telescope worth $3.50, for a self-inking printing-press and outfit; chase not less than 2½ by 3½ in. Eddie Judd, 260 Connecticut St., Buffalo, N.Y.

To exchange for offers: $20 scroll-saw, Seneca Falls make, $4 Bailey circular plane, set of Auburn metallic planes, brass-bound four-foot rule, fourfold, Traut's patent combined plow, dado, etc., cost $7. F. A. Rappleye, P.O. Box 12, Farmer Village, Seneca Co., N.Y.

Bee Hive wanted; one of the old-fashioned straw "skeps"; say what you would like in exchange. Apis, care of Young Scientist, 49 Maiden Lane, N. Y.

A first-class type writer, in excellent condition, cost $125.00, to exchange for good microscope, telescope, or valuable scientific books; send full particulars. A. B., Box 114, Lewiston, Maine.

A $30 stencil outfit (Spencer's) for a self-inking printing press in good condition, chase about 6 x 9; rich ores and minerals of Idaho for scientific and instructive books, printing press, type, etc. J. P. Clough, Junction, Lemhi Co., Idaho.

Wanted pyrites of iron from Colorado gold mines in exchange for sea shells and other gems; send list of what you have to exchange. S. Ferguson, Eureka Springs, Arkansas.

Scientific specimens of various kinds for same. Geo. E. Frazier, Caldwell, Ohio.

A banjo in good condition, two pairs of rosewood bones, three splendid games, and a fine set of drawing instruments, for a good cornet, viola, violincello or double bass. L. B. Hill, Kalamazoo, Mich.

Lester W. Mann, Randolph, Mass., Box 162, has Demas scroll saw, lathe and tools, emery wheel; $20 worth patterns; Smithograph; large harmonica, cost $1.75; novelties in seeds; for large self-inking press or offers.

10 volumes Chambers' Encyclopædia, American Book Exchange edition (cloth); Bonanza printing press, chase 3 x 5, card type, ink roller; spyglass, power 10 times; for French triplet, 1-5 in., or offers. H. P. Nichols, P. O. Address, Bridgeport, Conn.

A good telescope, also foot-lathe and saw combined, each worth $10.00, for shells, fossils or relics. Independent, Conncautville, Crawford Co., Pa.

Birds' eggs to exchange for others; send list of what you have to exchange. Emil Laurent, 621 Marshall St., Philadelphia, Pa.

Twelve or fifteen volumes of the American Agriculturist to exchange for scientific books or offers. W. H. Osborne, Chardon, Ohio.

J. D. Rice, P. O. Box 473, Trenton, N. J., would be pleased to correspond with mineralogists for the purpose of exchanging specimens and ideas.

To exchange, my collection of nearly half a thousand rare postage stamps with catalogue, for second-hand Flobert rifle; must be in good condition. H. E. Whitman, Station M, New York.

I have a large assortment of foreign stamps to exchange, also Confederate money. Collectors send sheet and I will return it with mine. Box No. 2, Coeymans, N. Y.

Electric bell engine, cost $15; pair of analytical scales, cost $10; pair of Bell Telephones to exchange for a printing press, watch or offers. Geo. N. Bigelow, Box 754, Palmyra, N. Y.

Any person wishing to trade bird's eggs may apply to me and I will send them my list of bird's eggs. I have only a few at present, but am receiving a number every month. A. G. G., Box 26, Summit, New Jersey.

Minerals of Idaho for Standard Works on the Horse—Wallace's Registers and turf journals. Wanted, also other useful books, bound and in good condition. Many varieties named in my list. J. P. Clough, Junction Lemhi Co., Idaho.

To exchange for offers first four (fifth when completed) bound volumes of YOUNG SCIENTIST. J. N. Brooks, P.O. 1468, N. Y. City.

Wanted engraver's tools with book of instructions, for a Victor Press, with cabinet, 2 type cases, type, ink roller and furniture complete; perfectly new. L. Warren, 72 Cumberland St., Brooklyn, N. Y.

A Fletcher Foot-Blower, cost $5, as good as new; will exchange for a Cushman, 2 in. or up scroll chuck, or other make; will give a satisfactory trade on the difference in price, if any. Louis Lutz, St. Clair Street, Toledo, O.

I have a lot of "Galaxy" (magazines) which I would like to exchange for an air rifle in good condition, a collection of birds' eggs, or offers. W. B. Greenleaf, 480 La Salle Ave., Chicago, Ill.

I have a Mechanical Telegraph with book of instructions, books, etc., which I wish to exchange for good microscopical objects, mounted on 3 x 1 slips. Address, with list, J. H. Frey, Millersburg, Ohio.

To exchange, "How to Use Microscope," Wells' "Natural Philosophy," and many other books, chemical apparatus, etc., for good photographic camera, and lenses. W. H. Weed, 254 Putnam Ave., Brooklyn, N. Y.

Wanted "Quimby's New Bee Keeping," for "Our Own Birds of the United States," by W. S. Baily; new. Joseph Anthony, Jr., Colota, Whiteside Co., Ill.

Wanted a good book in anatomy, in exchange for a book on chemistry, or for story books. A. G. G., Box 26, Summit, New Jersey.

A German-silver trimmed, patent lined, cocoa flute, cost $4, in good order, for good spy-glass, photo-material, or offers. Ewing McLean, Greencastle, Ind.

I have some fossil shells from the west bank of the Mississippi, to exchange for Indian relics. A. W. S., 187 E. 71st St., N. Y.

I have a magic lantern, Ruby pattern, nearly new, and 5 views; also "Our First Century," bound in leather, cost $7; state what is wanted in exchange. I. N. Spencer, Box. 217, So. Manchester, Conn.

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Wanted a book on treatment and care of canary, also breeding of same; will give in exchange book named "Market Garden, Flower Garden and Bees," or 40 "Scientific Americans" or "Seaside Libraries;" want also old books. M. J. Mulvihill, Norwalk, Conn.

The Young Scientist

SCIENCE IS KNOWLEDGE. KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

VOL. VI. NEW YORK, MAY, 1883. No. 5.

Amateur Wood-Carving. (*Continued*).

BY LEO PARSLEY.

IN treating the sunflower shown in Fig. 1, I have strictly adhered to the conventional style, which in cases of this kind is perhaps the most effective; the leaves and flowers are treated alike; they are, however, reduced in size, as space here is limited, but they can easily be enlarged by the amateur to either twice or three times the size, if desired.

The method of working to be adopted with this design is exactly the same as that described in my last paper for carving the ivy scroll panel. In carving fretwork, picture-frames or brackets, the same treatment is to be used, but in finishing off, it will be, in many cases, advisable to chamfer the edges of the leaves, etc., from the back, so as to take away

Fig. 1.—PANEL SUNFLOWER, CONVENTIONALLY TREATED.

the appearance of heaviness, which invariably results when the thick edges of leaves or flowers are left.

I noticed in the YOUNG SCIENTIST for January an interesting article on walking-sticks; and in case any of the readers

of this paper may feel inclined to make walking-sticks for themselves, I have given two grotesque designs, which may be carved on the heads of either walking-sticks or umbrellas. Fig. 2 is a suitable design for an ordinary knob, and Fig. 3 will suit a half-crutch admirably. If the reader does not care to go to the trouble of preparing a cane, he can easily buy one that will suit his purpose at a cheap rate. In carving heads or similar objects on sticks, it is always better to rely entirely on the grotesque for designs; and it will be an agreeable surprise to the amateur to find how easily these grotesque heads can be cut on a stick.

Fig. 2.—GROTESQUE DESIGN FOR KNOB OF WALKING-CANE.

The principal thing to avoid is all sharp points, which are liable either to hurt the hand or tear the glove; and the design should in every case be adapted to the size and shape of the knob. In carving these heads a vise or bench-screw of some kind will be required to hold the work firmly whilst being operated upon, and then the same process is gone through as with all other descriptions of carvings; first of all, draw roughly the design on the knob, then block out, and finally finish off the work, adding any fancy touches that may be deemed advisable to give effect to the design. It is a frequent practice with carvers to roughly model the design in clay before commencing to carve it in the wood, or if clay is not at hand, to chop in roughly the design in a piece of soft wood, so as to see the effect the design will really have in the wood when worked out.

In finishing off the work, outlines frequently have to be rectified, and alterations made, that are not noticed as being defective when the work is blocked out. When setting in the outlines of a panel, for instance, it is better to avoid cutting in too deeply, otherwise the groundwork presents a surface defaced with tool marks after the outlines have been corrected, and it is not always easy to efface these marks, even when the ground is punched. In shaping a design, however, it is a good

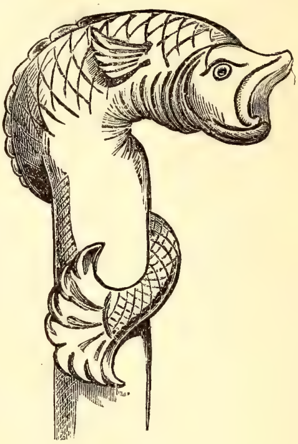

Fig. 3.—GROTESQUE DESIGN FOR HALF-CRUTCH WALKING-CANE.

plan to use the tools boldly and cut clean; instead of which, many beginners will make a dozen cuts where one would suffice.

Before closing these papers I will give designs and instructions for delicate carving in ebony, and will also give directions and designs for the now almost universal incised work.

Poisonous Plants.

BY A. W. ROBERTS.

POISON ivy, poison oak, poison mercury vine, poison swamp sumac, poison dogwood, and poison elder!

Are these not terrible names and villainous reputations to give to two of the most beautiful inhabitants of our woods, meadows and hedges? But though no one would suspect this poison ivy, oak or mercury vine, as it is called, that climbs up leafless tree-trunks, unsightly stone walls, rocks or fence-posts, of containing within its cheerful bright green

leaves such cruel and villainous qualities, nevertheless thousands of grown-up people and children have suffered intense pain and disfigurement by a very slight contact with it and even by standing in its presence.

This wretched vine prospers wherever it can obtain a foot of ground, let it be sandy, stony, moist or parched; contented and prosperous, it reaches forth

Fig. 1.—POISON IVY, SHOWING BERRIES OR FRUIT, AND ÆRIAL ROOTLETS.

its poisonous arms. Its scientific name is *Rhus toxicodendron.* "Climbing by rootlets over rocks, etc., or ascending trees, leaves with three leaflets, which are rhombic-ovate, mostly pointed, and rather downy beneath, variously notched or cut, lobed or entire" (Gray). And by habit it is essentially a climber, though when growing without support it becomes erect, robust and bushlike. Under these conditions it is commonly known as the poison oak, and was long considered by botanists as being a separate variety of the Rhus genus. The stem of the vine is almost smooth, except where the aerial rootlets or tendrils are attached to the under portion and sides of the stem. These tendrils are of a bright brown color when young, and of a dingy gray when old. The masses of fruit or seed vessels, when young, are of a light green color, but turn to an ashen gray when

Fig. 2.—LEAF OF POISON IVY (about half the actual size).

fully ripened. The leaf is smooth, and inclined to be shiny, curving downward from the midrib.

One would consider the poison ivy sufficient for all evil, but he has a relation, a very close relation, compared with which he is nowhere, and who is commonly known as the poison sumac, poison dogwood, poison swamp sumac, and poison elder, and by botanists as the *Rhus venenata.* "The branches are smooth, or nearly so, leaves odd-pinnate, leaflets 7-13, abovate-oblong, somewhat pointed at both ends, entire" (Gray). This fiend of our beautiful wild flora is ten times more severe in its poisonous qualities than the ivy. It flourishes and delights to dwell in meadows and on the margins of woodland streams. Unlike the poison ivy, which climbs and clings to everything, the poison sumac grows erect, often attaining

stately proportions—a height of twenty feet—but more commonly the proportions of a shrub or small tree. The leaves are smooth and nearly hairless, and resemble those of the hickory or Wistaria, but are much smaller. The bark is smooth; the

Fig. 3.—POISON SUMAC, SHOWING LEAF AND BERRIES.

fruit is contained in long, drooping and very shiny black or dark brown stems, and in general appearance closely resembles that of the poison ivy. In the fall of the year the leaves take on beautiful tints of red and yellow, and are often gathered by leaf collectors for household adornment. On one occasion three ladies having gathered bunches of these leaves, held them close to their faces, as a protection from the sun; all three became so severely poisoned as to be confined to their beds for six weeks. The berries, too, are often gathered for the same purpose, and numerous instances are known of people having been poisoned by sleeping in rooms containing ornaments composed of these berries. The other day I met a collector for fresh-water aquaria, one who has tramped the woods, marshes and streams for twenty years, strong, robust, and abstemious in his habits. He had always handled the poisonous ivy and sumac with impunity, but at last he got a terrible dose of sumac poison, which sent him to bed and in the doctor's hands for over a month. It must have been that his system had undergone some change which placed him in a condition to become severely poisoned. Some years ago I contributed the following experience to a contemporary journal. It was at that time the fashion to wear large wreaths and bunches of artificial flowers inside and outside of ladies' bonnets. The flower-makers being hard pressed for material, made use of dried grasses, seed vessels, burrs and catkins. These were painted, dyed, bronzed and frosted, to make them attractive. I became greatly interested in the business and the ingenuity displayed, and spent much time in examining the contents of the milliners' windows. On one occasion, when standing before a very fashionable milliner's window on Fourteenth street, I was horrorstricken on discovering that an immense wreath of grayish berries, which constituted the inside trimming of a bonnet, was composed entirely of the berries of the poison swamp sumac, just as they had been gathered, not a particle of varnish, bronze or other material coating them. The bonnet, when worn, would lay this entire mass of villainous berries on the top and sides of the wearer's head, and a few of the sprays about the ears and on the forehead. Stepping into the store, I addressed the proprietor and asked her if she knew that the bonnet was trimmed with the berries of one of the most poisonous shrubs known in the United States. After staring at me in a sort of puzzled way, she informed me that I was mistaken, that she had received those flowers direct from Paris only a week ago.

"Madam," I replied, "there must be a mistake somewhere, for those are the berries of the poison sumac, which does not grow in Europe." She gave me one angry look, asked me to please attend to my own business, and swept away from me to the other end of the store. A few days after this I read in the daily papers

an account of the poisoning of a number of small girls employed in a French artificial flower manufactory in Greene street. I at once guessed the cause. I visited the factory mentioned, introduced myself to the proprietor, told him what I knew about the poison berries—and was rudely requested to make myself scarce. After these two adventures I made up my mind to keep my botanical knowledge (poisonous though it might be) to myself. When in the army I came across a very curious case of poisoning with swamp sumac and poison ivy. A creature having the form of a human being, and wearing the uniform of a soldier, was found in a solitary tent, which was pitched in an abandoned and desolated plantation. This creature's body had the appearance of having been scalded, and his eyesight was nearly gone; in fact, we were afraid to touch him, fearing that he had some terribly infectious disease. But why was he there, alone and deserted? Not even a sanitary guard over him to prevent all communication except by the doctors. He did not seem to care to talk much about himself or his situation, or state why his comrades had left him there to die. Being on the march, all we could do was to leave him extra rations, water and tobacco. But we afterwards learned from members of his regiment that to avoid duty and an engagement, he had poisoned himself by building a fire of green poison ivy and swamp sumac, and had actually submitted himself to a vapor bath of these two poisonous materials. He was a professional bounty-jumper, and had taken this means to get out of the army. He was never heard of afterwards, as he fell into the hands of the enemy. With farmers and farm-hands, in the spring of the year, many severe cases of poisoning have occurred from standing in the smoke when burning brush which was composed of poison ivy and sumac.

—Look not mournfully into the past—it comes not back again; wisely improve the present, it is thine; go forth to meet the shadowy future without fear, and with a manly heart.—*Longfellow.*

Indian Clubs, and the Way to Use Them.—IV.

BY JAMES A. SQUIRES.

EXERCISE 13 (Fig. 15).—Another difficult one. The clubs are swung downwards, parallel to each other, and then raised up behind the back (as shown by the dotted arms), then swung to the front again, and

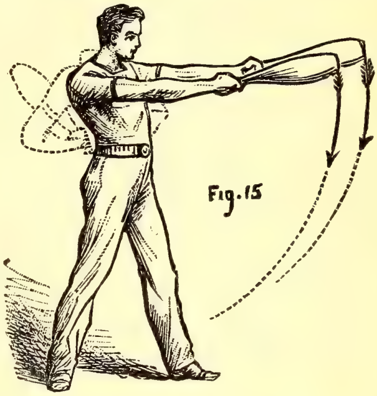

Fig. 15

in a circle completely round at arms' length. The left club executes exactly the same movement as the right in the last exercise (12), but with the right club in this the movement is different. The wrist should be twisted sharply downwards, and the club *tucked under* the right arm; its own weight will then carry it down behind the back, and up to a level and in a line with the right shoulder, reaching that position exactly at the same time as the other club, and both will thus again be parallel, but on the opposite side of the body to that from which they started.

Exercise 14 (Fig. 16).—This is purely wristwork. The arms are extended straight out on each side, and the clubs passed alternately from the wrists in the front and rear of each arm, describing circles on either side. At the same time that one club is swinging round behind the right arm, the other is swinging in front of the left, and *vice versa*. This exercise causes the wrists to become very pliable.

We have now completed our instruc-

tions for the "light clubs." The learner must, of course, acquire the different exercises separately, one by one, but when mastered they can be continued from one to another, making, when so combined, a very effective performance. The movements capable of performance with Indian

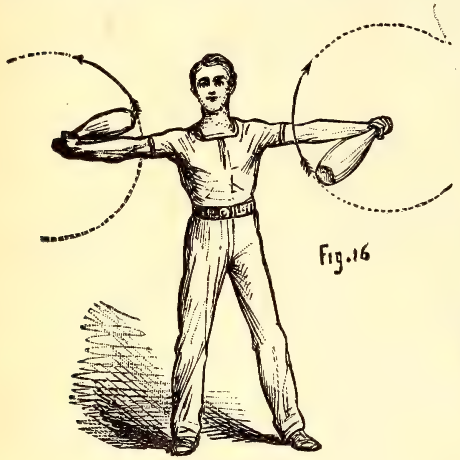

Fig. 16

clubs are almost without limits, but space will not permit us to give further descriptions or illustrations. The performer will find, as he becomes accustomed to the use of these clubs, and attains proficiency in their manipulation, that other movements will suggest themselves, and he will be able perhaps to invent some new and intricate exercise.

Single, or "Heavy," Club Exercise.—Roughly speaking, the weight of a club to be used singly should be about the same as that of the *pair* the performer is accustomed to—*i.e.*, a boy using two clubs weighing 6 lb. each should use *one* weighing just double. This will be found quite sufficient for sustained movements; if a heavier weight is adopted there is danger of over-exertion, and the exercise cannot be performed in a graceful and easy manner. We think the best shape for a heavy club is that shown in Fig. 17, which, our readers will observe, differs from the light clubs in having a "shoulder" instead of a gradual slope from handle to base.

All the exercises described above, with a few exceptions, can be performed with a heavy club, but, of course, with only one hand at a time—the other hanging loosely down by the side (as in Fig. 1). When one arm becomes tired the club should be changed to the other (see Fig. 17), but without the movements of the club being stopped. The exceptions referred to are the wrist twists, which should not be attempted with a heavy club, the strain upon that part of the arm being too severe.

It was with considerable diffidence that the writer undertook the task of penning

Fig. 17

these articles, feeling strongly the difficulty of explaining the numerous and intricate movements in *words;* but, with the aid of the illustrations, he trusts that the directions will prove sufficiently clear to enable those readers of the Young Scientist who desire to become expert in the use of the Indian clubs to succeed fully in their endeavors.

Winter Rambles.—II.

BY A. W. ROBERTS.

INTRODUCING myself to the doctor, I told him of my adventure and manner of capturing the butterflies. He was greatly interested, and in truth patted me on the back for being so enterprising a young naturalist, which of course had the effect of placing me on very good terms with myself. He urged me to keep my win-

dows closed till he could call on me in the afternoon, as some of the butterflies might escape, though it was very rarely that they used their wings during the daytime, they being nocturnal in their habits.

How anxiously I awaited his arrival can be well imagined, and when he did visit me, how much wonderful information I gained from him! In the first place, he informed me that they were not butterflies, but moths, and that their scientific name was *Attacus cecropia*, and by this name they were known throughout the scientific world. He further told me that all known insects, birds, fishes and flowers, etc., etc., had been christened by scientists, so that were I to take one of these moths to a German professor of entomology, who might not be able to speak or understand a word of English, he would call it by its scientific name. This was a new revelation to me; in fact, from the first discovery of these moths in the room up to my interview with the doctor, I began to feel that I was about to enter a mysterious and entrancing wonderland, containing unknown and even unsuspected possibilities of creation.

Fortunately I possessed two redeeming good qualities, which now stood me in good stead. I was a respectful listener and an enthusiastic and tireless questioner. How many boys have slipped up in this world just because they were too proud to show their ignorance about a subject by asking questions, and thus gathering information. He also informed me that I was in possession of enough material with which to make exchanges both in this country and Europe, and thus to get together the nucleus of a very nice collection of American and European butterflies and moths. I could not keep back an expression of doubt at this statement, but when he informed me that 99 per cent. of all the yellow eggs that had been and would continue to be deposited in the room, would, in course of time, become moths, if properly taken care of, and that the hatching out of them was not only very simple and interesting, but also very instructive pastime, it being identical with the raising of the silk-worm cocoons and moth of the silk-worm, that had been practiced so many thousand years. He also gave me instructions how to kill the moths with chloroform, so as not to cause them any pain, and how

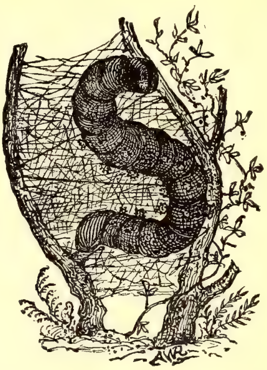

Fig. 1.—CATERPILLAR SPINNING ITS COCOON.

to mount and preserve them for the collectors; also to distinguish the males from the females. After collecting all the eggs together, I spread them out on clean damp cloths (old sheeting), to which the eggs became firmly fastened after the moisture had evaporated, they being coated with an animal glue. These eggs were exposed to the *morning* sun for two hours each day, and at night were brushed over with a goose feather and warm water. In a few days little black mites of caterpillars began to break through the eggs and wander round on the cloth in the most hungry manner. I had brought quantities of elder branches from the woods, which were placed in jars of water, to keep the leaves crisp and fresh. From the tenderest leaves of the elder branches I made a fine hash of elder leaves, which was sprinkled on the cloths. What a sense of deep satisfaction passed through me on first beholding the black mites swarm over the elder hash and begin devouring it with greedy eagerness. Day after day I tended them. Before going to school enough food was given them to last till twelve o'clock (my dinner hour from school), when more food was given them to last till four o'clock in the afternoon. The quantity of food that they devoured in twelve

hours' time was something astonishing. Eating so much and growing so fast, they had to moult or cast their skins every few days. And so I kept on feeding and

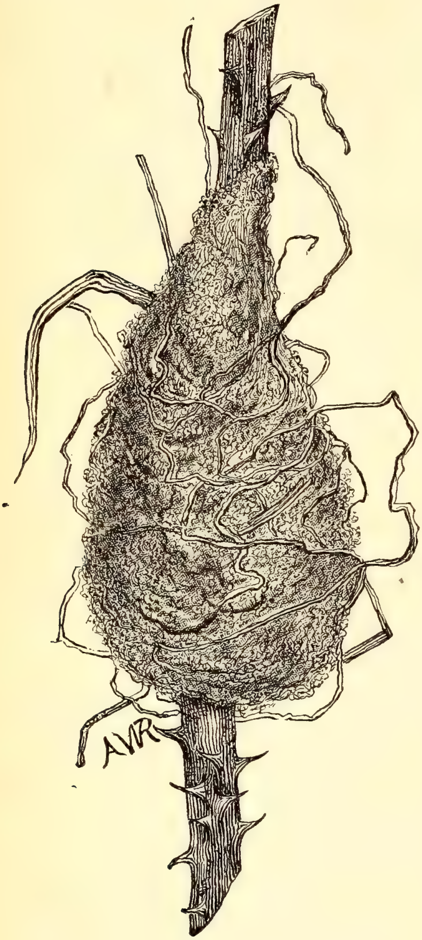

Fig. 2.—COCOON OF ATTACUS CECROPIA.

feeding these voracious creatures, till they had attained one inch in length, when one day I determined to transfer them to the elders growing along the stone walls of Johnson's woods, and let Mother Nature take care of them for the rest of their lives. This was a long and tedious performance, for the doctor had strongly cautioned me never to touch the young caterpillars with my fingers, but always to brush them with a goose feather on to a piece of clean paper or into a clean saucer.

Anxiously I watched them all summer long, as they grew so round and plump and green, with the strange little orange-colored knobs that grew from their backs and sides, and from which sharp and short black spines projected in every direction. At last the fall came, and they began to become uneasy, and ceased to take any more food. Then they began solemnly and slowly to pass down the

Fig. 3.—EGGS OF ATTACUS CECROPIA ATTACHED TO LEAF.

tall slender canes of the elders to within a foot or less of the ground, where they began spinning their cocoons, much after the fashion shown in the accompanying figure 1, and in two weeks' time all the caterpillars had completed this operation and passed into their long winter's sleep, encased as shown in Fig. 2.

How many cocoons of the Attacus cecropia I gathered that fall I cannot remember, but I do know that my room was festooned and draped with them on yards and yards of thread, to which I had attached them, and that in course of time by exchanges I got together not a large but a very satisfactory collection of insects.

As some of my young readers may in their summer rambles come across the eggs of the Cecropia in a state of nature, I herewith give a figure of a leaf with the eggs as usually attached. Such leaves, if kept in the house, will soon hatch out, and the young caterpillars may be fed and reared in the way already described.

Something About Saws.—IV.

BY "OUR NED."

HAVING fairly described, from an amateur's standpoint, the methods of filing and using hand-saws, I will now take up the smaller saws that the amateur will be sometimes called upon to use.

The most common saw in use after the hand-saws and back-saw is the compass-saw, an illustration of which I give at Fig. 1.

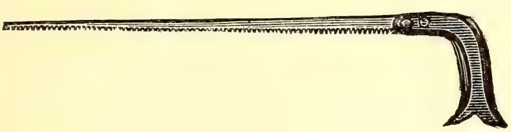

Fig. 1.

The average length of the blade of this kind of a saw is about twelve inches, but many of them are made longer, and some few of them shorter; and the width of the blade is usually about one and a quarter inches near the handle, and one quarter of an inch at the point. They very much resemble the ordinary hand-saw in their general construction, the handle being attached to the blade by rivets, in the same manner as hand-saws, but being of a somewhat different shape. The teeth are formed very much like the teeth of a fine hand-saw designed for cross-cutting soft wood, being, perhaps, thrown a little further forward or made more hooking.

In using these saws much care should be taken when following a line around curves having short radii, or it will be apt to "kink" or buckle, or perhaps break. To prevent this class of saws from snapping, I have often filed them, so that the teeth would pitch towards the handle instead of to the point; this expedient forced the blade to perform its work on the pull stroke, which, in my opinion, is the proper manner for all narrow-bladed saws to labor, unless they are strained from both ends, like the bow-saw shown at Fig. 2, which, being held at both ends, will perform its work nearly as well one way as another.

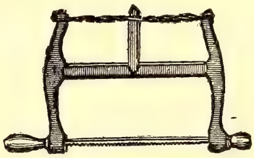

Fig. 2.

Saw blades of this class should be thin on the back, which not only gives them clearance, but aids them materially to follow a line closely round short curves.

The pad, socket, or key-hole saw is something shorter and narrower than the compass saw, and is not fastened to the handle permanently. The blades are sold separately, and may be obtained any length from six to fourteen inches, and containing teeth from eight to eighteen to the inch. Fig. 3 shows the wooden "pad" or handle generally used for these kind of saws; there is a slit or mortice down the whole length of the handle, so that the blades can slip down, leaving only so much out of the handle as may be

Fig. 3.

required. The blade is held in position by two set-screws, which are operated upon by a screw-driver. This is an excellent arrangement, as it enables the person using the saw to adjust its length to suit the work in hand. Saws that have been broken, if not too short, may be used again, but if it is the shank end of the saw that is used, the end should be

filed to a point or rounding, so that it will not catch and stick in the work.

It is more particularly desirable that saws of this kind should have the teeth so shaped that all the cutting will be done on the pull stroke, and it will always pay the amateur to file the teeth so that this will be the case.

Another form of this saw is shown at Fig. 4, where the pad is made of iron in-

Fig. 4.

stead of wood. These are purely American make, and answer very well; they are much cheaper, and for many purposes just as useful for the amateur's purpose as the more expensive pad.

Fig. 5 shows a nest of saws all made to

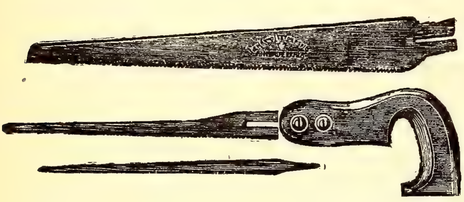

Fig. 5.

fit one handle. This is a very convenient arrangement, and answers very well when an amateur wishes to have a full set of saws. The largest blade is called a table saw, and will answer very well for cutting round large curves. The second-sized blade may be used for a compass-saw, and will cut circles of a much less radius than the table-blade; the smallest blade takes the place of the pad or key-hole saw, but has the disadvantage of being obliged to work with its whole length extending from the handle.

The web-saw, the same as shown in Fig. 2, is a long narrow blade, being of equal width all its length, and having a hole in each end, by which it is connected to the handles which pass through the frame. These handles are made to fit loosely in the frame, and can be turned so that the saw will present its teeth in any direction; and the saw can be disconnected from the handles instantly. The object of having the saw arranged in this manner is to enable the operator to work inside frets or scrolls. This is accomplished by first boring a hole through the stuff to be cut, and then inserting the saw, which must be fastened to the handle again, after which the operation of sawing may be commenced. In using this saw it is necessary to observe that the blade is in a true line and out of twist.

The crossbar of the frame prevents the saw from working in the stuff very far from its edge, thus making it necessary in cases where the stuff is wide to complete the pattern with pad or compass-saw.

Some mechanics are very expert with the bow-saw, and will turn out very fine work with them, but the majority of workmen know but little about them, and the introduction of the jig-saw and the American scroll-saw has completely superseded it in the large workshops and factories, where it was once quite a common tool.

With regard to filing this class of saws, it may be said that all should be treated alike, and the method of filing one applies to all.

As shown in previous papers on this subject, a saw intended for cross-cutting will not rip satisfactorily, neither will a saw cross-cut that is designed for ripping; nor will the ripping or cross-cutting saw do satisfactory work where the fibres of the wood have to be severed at all angles. Hence the necessity of giving the class of saws under discussion, teeth that partake of both the rip and cross-cut teeth.

This is done by making the teeth point pretty well forward, like those shown in Fig. 6, and filed square on the back and

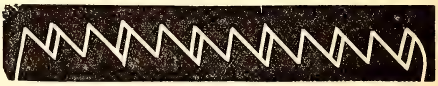

Fig. 6.

slightly beveling on the cutting edge of the tooth. The teeth shown are larger than those used in pad-saws or in saws

intended for frame, but are just about the right size for table and compass-saws. The clamp shown in a previous paper will answer very well for holding any of these saws that are wide enough to be held, and when the blades are very narrow they may be filed in an iron vise or any other similar device.

Casting in Plaster of Paris.—III.

BY MARK MALLETT.

Tools Used in Casting.—Wax Moulding.—Piece Moulding.—Elastic Moulds.—Casting from Natural Objects.

(Continued from page 119.)

THE tools required for casting are few and simple, a basin and spoon being the chief. Yet for backing up both mould and cast, a mason's trowel of small size will be found useful, and a "drag" will be required for smoothing the backs of casts, grounds, etc. A drag some three inches long, such as that shown in Fig. 1, can be cut with a file from any piece of flat steel; an old steel stay-bone, for instance, makes capital drags. For use in mending, and for various purposes, a small steel spatula will be indispensable. This instrument is shown in Fig. 2. It costs about twenty cents. One end forms the spatula, the other is a notched blade for scraping plaster. Those commonly sold have angular teeth, but an improved form has square teeth like those of the drag. These give a far better surface to the plaster. For working on the plaster cast, small gouges of various degrees of curvature (Fig. 3) are sold, also "riffles," which are diminutive rasps; but these things may well be done without by the beginner.

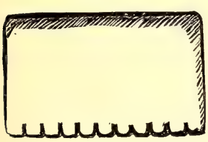

Fig. 1.—DRAG FOR SMOOTHING BACKS OF CASTS, ETC.

Indeed, good and experienced modellers, as a rule, avoid working on the plaster cast as much as possible, choosing rather to finish their work carefully in the clay. A far better surface, whether for delicacy or effect, is to be given in the latter material. It is rather the young modeller, who is in undue haste to cast his work, who will find himself obliged to give much time to touching-up his plaster. The tyro will see defects in the cast which had escaped him in the clay. More especially he will be sure to find that it has a "lumpy" appearance—that there are hills and hollows where there ought to be flat surfaces or regular curves, and this he will have to remedy. Sand-paper, if used firmly, will do this. The right sizes are middle and fine No. 2; coarser will scratch the work, and finer will become choked directly.

Fig. 2.—COMBINED SPATULA AND SCRAPER.

Fig. 3.—GOUGE FOR PLASTER CASTING.

It should be remembered that it is whilst fresh from the mould that the cast is in the best state to be worked upon. There are cases in which the mould may be worked upon with advantage. For instance, suppose the model to be a relief, and that in course of the work the background on which it is formed has lost its original truth and evenness. The projections of the model may render it difficult to get at and correct this. But in the mould, where everything is reversed, the ground becomes the most prominent and easily reached part, and by the use of the drag we can in a few minutes make our ground perfectly true and smooth. Again, we may wish to put a name or other inscription on some part of our model in raised letters. To model raised letters in the clay would be a work of considerable time; by incising them, in reverse, in the mould, which will be quickly done, we shall secure precisely the same result, as the letters will appear raised in the cast.

Some persons object to the brilliant whiteness of plaster, and like it better "toned down." It must be admitted that the effect of toned plaster is more artistic. Yellow ochre imparts a pleasing tone. To give a uniform tint take as much water as there is any possibility of your requiring for mixing the fine plaster

used in facing your cast, and stir in ochre. A slight tinge will suffice—much does not look well, and moreover softens the plaster, and then, as there will be a sediment, pour off your colored water for use into another vessel. It is important to mix enough, as it would be difficult to make a second quantity of exactly the same shade.

The directions given above, so far as they treat generally of the mixing and management of plaster, will equally apply to casting models of other shapes. I have taken a "relief" as an example, because it is the most simple form, and can be cast in a single piece. Such additional instructions as may be required to enable the amateur to waste-mould a model in the "round," can be quickly given.

Instead of a panel, let us suppose that a vase has been modelled. This may serve as an illustration of a simple object in the "round." If we try to mould this at a single operation, we should find it impossible either to extract the clay or to clean the mould. The mould must therefore be made in two pieces.

To prepare this model for moulding, as shown in Fig. 5, we must make a strip of clay, the sixth of an inch thick, and about two inches wide, and stick it edgewise round the vase, so as to divide the latter into two equal portions. This collar can be supported by wire pins, as shown at A, A, A. One side of the vase can now be moulded, for the collar of clay will prevent the plaster from reaching the other side. When the first half of the mould is set, the collar must be removed, and conical holes made at intervals, with the end of the scraper in the edge of the mould thus left bare. These are "key" holes, and as when the other half of the mould is cast, corresponding "keys" will be formed to fit them, they will enable the two halves to be put together with the nicest precision. Some clay-water must be brushed over the edges, to prevent the two halves adhering too closely, and the remaining part of the mould can then be cast. When a model has to be cast in an upright position, as is the case with a bust, or with this vase, plaster cannot be poured upon it; it must be thrown on with the spoon.

The mould being finished, its two halves will easily be forced apart by the mallet and chisel. The clay can then be removed, the mould cleaned, and fitted together again. The keys will ensure the pieces fitting accurately. They then have to be tied together as tightly as is possible. Perfect tightness is to be secured by tying a piece of string or cord, according to the size of the work, loosely round the mould, passing a piece of stick through it, and twisting the stick round and round. When you can screw it no farther, secure the stick from untwisting by tying it fast. You can then pour in the plaster gradually, and well shaking and turning the mould about whilst you do so. When the mould has been chipped off, a little seam will appear on the cast where the two pieces of the mould met, which will have to be cleaned off.

A bust might be moulded in the above manner; but if so, the seam would necessarily pass down the ears and along the neck and shoulders, where it would be highly unsightly. The method shown in Fig. 4 is therefore generally preferred instead. By thus making a "pot-lid," the seam is formed only on the hair, in a part where it will be little noticed, and the opening thus made will allow of every purpose of emptying and cleaning the mould of the head.

Sometimes a portion of the mould may project from the general mass of the work so far, that it would be a difficult matter to mould it *in situ*. If so, it may be cut off with a fine piece of wire, and moulded separately, and afterwards refixed in its place.

As a cast becomes dry, a disagreeable yellow tinge, the result of some impurity in the plaster, will sometimes come to the surface. To obviate this, the cast should be placed with its *back* to a fire, and so dried. As the water evaporates, it will bring out the discoloration on the side by which it escapes, and the front of the cast will thus be uninjured.

Wax Moulding.—The above is the ordinary and most useful method of waste-moulding; but there is another, which is

sometimes applied to delicate models, which will not bear the use of mallet and chisel. This is practiced by pouring melted wax over the model, to form an inner mould, and then backing, as usual, with plaster. This wax mould can be pulled away from the cast, with a little warming, without danger to the finest work.

It is by one or other of these processes that the clay model has always to be transformed into a plaster cast. But if it is required to multiply copies of such casts, or of other suitable objects, other means than waste-moulding will have to be resorted to. This must be done either by an elastic mould or by a piece mould.

Elastic Moulds.—First, as to the elastic mould, which is recommended—by its simplicity, and the ease with which it can be made—for those purposes to which it is suited. Its value may readily be perceived. Fig. 6 may be supposed to represent one quarry of a diaper, which has been modelled, and of which a number will be required. Fig. 7 shows the same in section.

It is plain that no mould formed in a single piece from any rigid material could leave this panel without breakage; but we get over the difficulty if we make our mould of some substance so yielding as to allow it to be drawn over the projecting points seen in the section, and so elastic as, when drawn off, to recover its former shape. From such a mould we can take as many casts, in moderation, as we may require.

Various substances have been used for making such moulds, but that most approved by the best moulders is gelatine. Having first made a single cast by the waste-moulding process, take best sheet gelatine 1 lb., beeswax ½ oz., water ¾ of a pint. Boil them in a glue-pot till they form a thick syrup; rub a little oil (or what is better, hog's lard) over your cast, and then pour on the mixture. It should be used warm, but not boiling. The best and purest gelatine, at about fifty cents per pound, should be used. Some use glue, or cheap gelatine; but these cannot be recommended. When the mould comes to be filled, the plaster grows warm in setting, and the heat thus generated is apt to melt an inferior mould.

Piece Moulding.—By this method objects in the round, objects in relief if they are large, and indeed most objects from which a casting mould is required, are moulded. It is by this method that the cheap plaster images, and almost all the plaster casts sold in the shops, are produced.

[NOTE.—The cuts, 4. 5, 6 and 7, referred to in the text, will appear in next month's article on "Casting in Plaster of Paris."—ED.]

(To be continued.)

Overglaze Painting on Porcelain.

BY AURELIO DE VEGA.

ANTIQUITY *of Pottery Ornamentation.*—The decoration of articles made of clay is one of the evidences of that longing for ornament of some kind or other, which seems to be inherent in man, and we accordingly find that the art of producing on clayware, in such a manner that the result should be permanent, devices of a color different from that of the ware, is prehistoric; the earliest records on this point being in fact induced by the circumstance that excellence had already been achieved in the art.

2. *Superiority of Porcelain to Earthenware.*—For our purpose clay goods may be divided broadly into two classes—opaque and translucent: the former comprising earthenware, majolica, and the like; the latter, porcelain or china. The worth of earthenware may vary between that of the commonest clay crock and the finest piece of stoneware, or majolica; but the value of porcelain, which is of a superior basis, of a more delicate texture, and more expensive to produce, varies within comparatively small limits. That is, of course, at the time of production, and with due regard to the amount of work entailed in forming the object into which it is to be made. The specimens which realize such extraordinary prices among collectors have an enhanced or a spurious value from being ancient or typical, or from the mere determination of a person to become the purchaser. My remarks upon decoration are made primarily with reference to porcelain; not simply because it is the finer and intrinsically more valuable material, but also, and principally, because upon it work more excellent in appearance can be produced. At the same time it will be understood that they apply also to earthenware.

3. *Underglaze and Overglaze Painting Compared.*—Ceramic painting is of two kinds, underglaze and overglaze. The former is executed on the bisque, by which name the ware is known when it has received its first firing, and before it is glazed; the latter is, as its name implies, done upon the glaze, or that glassy surface which gives such lustre to the ware. Each of these modes of decoration has its ardent apologists. Accordingly, it is as well at the outset to admit that of the two kinds, an underglaze painting when executed with the touch which should be employed, and when strictly achieving its true aim, is undoubtedly the finer, comparing as it well may, for effect, with the finest oil-painting. Such a work as this is practically imperishable. On paintings made with, and on, other materials, time lays his finger to their ultimate effacement or decomposition; but an underglaze painting will endure in all its completeness and beauty as long as the ware, on which it is done. An overglaze would, considering the care which would naturally be taken of it, be perhaps but little less enduring; the difference being, that in the former case the colors become united to the body itself, their beauty being developed by the overlying glaze; in the latter they unite with the glaze only. In addition, as regards appearance, the overglaze picture does not, as a rule, present that crispness and boldness which distinguish the perfect underglaze work.

4. *Advantages of Overglaze Painting.*—The foregoing concessions have been made in order that it may not be supposed it is desired to unduly enhance subsequently the value of overglaze work; but, having been made, due recognition can be given to the superior claims of such work to the attention of the average amateur. These are numerous and important.

(a.) The scope of underglaze work is limited by the smaller number of colors available. In order that the bisque painted in oil may be brought into a condition to take the glaze, it is necessary that it should be raised to a red heat, so that the whole of the oil, which would of course refuse to combine with the glaze, which has a watery medium, may be dissipated. There are, however, only a few of the pigments obtained from the same sources which supply those for overglaze work, that can, after passing through such an ordeal, resist the action of the constituents of the glaze; some changing in tone or tint, others disappearing altogether. Hence overglaze work has the great advantage of a much wider selection of colors, and consequently a more extended range of subject.

(b.) Not only are underglaze tints less numerous than overglaze, but with a few exceptions, they do not comprise those brilliant, not to say gorgeous hues, which can be produced in the latter, and which are so essential in certain styles of decoration. An underglaze painting is, generally speaking, quieter than one done over the glaze; and hence, frequently, with a view to perfect the effect sought to be attained by work on the bisque, the assistance of enamel color on the glaze is called in.

(c.) Overglaze work does not make such demands upon the judgment of the painter as does underglaze. In the case of the latter the hue of the pigment as laid on is very often entirely different from that developed in the glazing; whereas, in the former case, the color laid is, as a rule, the same as that which will appear fixed after the firing. There is frequently also, in underglaze work, a difficulty to determine the exact depth of color employed, which, when at all existent in overglaze, is so to only a very slight extent. And, generally, overglaze work is less troublesome than underglaze.

(d.) The expense of glazing is considerably greater than that of simple firing, which is all that is necessary to fix the painting in overglaze work.

Hence it is abundantly evident that for the amateur whose desire is presumably to produce, with a view to decoration, an effect brilliant as well as artistic, painting in overglaze or enamel colors offers at once the wider and cheaper, and practically, equally enduring means of gratifying his wishes.

5. *Prospectus.*—The remarks which follow will be found to afford, so far as is possible in writing, a complete course of instruction in all that essentially appertains to overglaze painting. It will be readily understood that written directions, considered alone, sometimes fail—taking for example the subject of matching tints—to bring about the *exact* result desired or described. The earnest student, however, fairly appreciative, and possessed of ordinary powers of perception, will meet with a full and sufficient guide to enable him to embody his ideas in color.

I propose to consider in order the nature of porcelain and its glazes, and the mode in which the latter affect the appearance of the painting; the scope of the amateur's work; the apparatus and appliances necessary or profitable to employ; and the vehicles which should be used in laying the pigments. A work will then be undertaken in monochrome, or one color shaded either with itself or with some allied color; in carrying this out the several processes best adapted for outlining and laying the background under different circumstances will be reviewed. A detailed description will then

be given of the standard colors, or those in regular use, and ordinarily procurable; of their mutual behavior in mixtures, and of the manner in which composite tints generally may best be obtained, and with this information in hand work in colors will be commenced.

6. *Porcelain and its Glazes.*—In order that greater discrimination may be exercised in subsequent operations, it is desirable that the nature of porcelain and its glazes should be understood. I do not propose to give a history of pottery, or a detailed description of the processes employed in the production of that beautiful ware now so easily and cheaply obtainable. Such a course would serve no useful purpose. A section on the subject would be highly interesting, but the greater portion of the information it would afford would be of no practical avail, and complete descriptions are readily attainable in public libraries, and are more fittingly found in the pages of an encyclopædia, or a Dictionary of Art or Manufactures, than in a paper of such a series as this, the main object of which is the satisfaction of the wants of the practical amateur *painter.* It is, however, essential that the painter who is desirous of attaining something more than mere mediocrity in his art, should be possessed of correct information respecting the two particulars to which I have just referred, as without this knowledge it is very probable that he will fail—however well he may have worked—to realize his ideal, seeing that similar work executed with equal care upon two glazes of different descriptions may produce results so entirely different, that in one case the liveliest satisfaction may be experienced, in the other the keenest disappointment.

Porcelain, then, is of three kinds, technically known as *Hard*, *English*, and *Soft*, the last being also called *tender*, or *spurious*, and the first also *genuine.*

(a.) Hard Porcelain.—The body of hard porcelain is essentially composed of two substances, both of which occur naturally: 1. Kaolin, or as it is sometimes called, China clay, an argillaceous earth, the most valuable beds of which have been found in China and Japan, in Saxony, in France near Limoges and near Bayonne, and in England in Devon and Cornwall—the English variety resembling the Chinese and Japanese rather than the Continental. 2. China stone, a quartzose felspar, here called "crockery stone." These two substances occur in the formation called "graphic granite," but whether they have resulted from the decomposition of the granite, a further stage having been reached in the case of the former than in that of the latter, or whether they are constituents of imperfectly formed granite, the latter being more developed than the former, is not yet determined. Their origin is, however, noticeable, as they are causative of the hardness of the ware. By whatever means brought about, the important point is that the stone contains a large portion of alkaline matter, but little of which exists in the clay, and is accordingly fusible, or capable of being reduced to a molten mass, while the clay is infusible, or under heat retains its earthy character, and becomes of a brilliant opaque whiteness. The stone thus acts as a flux to the clay, and it is to this flux that nearly all hard porcelain owes its translucency.

The principal seats of this manufacture are the district round Limoges and Sevres. Hardware is also made in districts bordering on the Rhine (Sarreguemines, Saarlouis, Vaudrevange, Mettlach, Maastricht), at Meissen (Dresden), Berlin, Vienna, St. Petersburg, etc. The Chinese and Japanese ware also belongs to this class. In England hard porcelain was first made by Cookworthy at Plymouth (A.D. 1760), subsequently at Bristol, and later at some of the Staffordshire works.

(To be continued.)

Amateur Boat-Building.—I.

IN order to prevent any misconception as to the scope or object of the "Hints on Boat-Building," which we purpose to offer in the pages of the YOUNG SCIENTIST, a few words of introduction may be expedient.

In the first place, then, the "Hints" are not intended for the instruction of professional boat-builders. They are, on the contrary, mainly addressed to the large and increasing class of amateurs who desire to build their own "boat" at small expense. The instructions conveyed will, therefore, necessarily be of an elementary character, and the general style of the papers somewhat discursive.

Secondly, it must be distinctly understood that in describing any particular manner of performing an operation, or recommending any special style, we shall not mean that such are the only ones—nor, indeed, necessarily the best. They will be simply those which commend themselves to us, and may, perhaps, in many cases be taken as hints for the ingenuity of our readers to improve upon.

In starting, let us briefly describe the more usual forms of boats used on rivers.

The simplest form of boat may be taken to be the flat-bottomed, square-ended concern known as a "punt," and much in use for angling purposes. This form of boat is very safe, and is capable of going up shallow and weedy or muddy streams, where it would be impossible to get any-

thing else along. A pole is frequently used as the means of propulsion in such cases. Punts are sometimes made in much improved forms, combining lightness and very small draught of water. The punt is one of the easiest boats for the amateur to begin upon.

Boats constructed to accommodate one person are usually termed "sculling boats," from the word "scull," applied to oars of the kind and dimensions adapted to the manipulation of one individual, who holds a scull in each hand.

The name "dingey" (pronounced with the g *hard*, as in "go,") is variously applied. A short, strong, tubby boat is usually understood by the term; but it is also sometimes given to a short skiff of sixteen or seventeen feet in length.

The pair-oared "gig" and "skiff" are two very common and useful forms of rowing-boat. Some skiffs closely resemble the gig; there are, however, always minor points of difference. For example, a skiff is curved between the rowlocks, which is not the case with a gig; that part of the keel which ends at the prow is also much more perpendicular in the gig than in the skiff.

A boat which is constructed to combine in a measure the qualities of a pair-oared boat and of one propelled by sculls is known as a "randan." Here the sculler sits amidships, with one rower before and one behind him. This arrangement may be considered somewhat unsightly; but it has some not inconsiderable advantages for travelling over long distances.

Sometimes a pair-oared boat is fitted with rowlocks for double-sculling, which has of late come rather into fashion. Where there is a marked difference in reach between two oarsmen, double-sculling has a distinct and undeniable advantage over rowing. Occasionally, also, a randan is fitted up for three pairs of sculls, if required.

Amongst other varieties of boat we may specify the "funny," which is an open outrigged sculling-boat, alike in form at both stem and stern, and having a keel which falls away at each end in a sloping curve. The "whiff" is a similar boat, but has an upright stern, not sloped away as the bows are.

"Outrigged" boats are those in which the rowlocks project laterally outwards, in place of being formed on the side and in the substance of the boat itself. The rowlocks, or "rullocks," are generally borne on light ironwork, and as their projection enables them to afford sufficient leverage to the oars, the boat can be correspondingly diminished in width, and greater lightness by this means obtained. Boats of this kind are made of various sizes, from those adapted to contain a sculler only, to those suited for two, four or often eight oars. There is considerable variety in shape also, within certain limits. When the boat is sharp at both stem and stern, as just described in the sculling-boat, it is termed a "wherry," but when made upright at the stern, like a whiff, it is known as a "cutter." Wherries are seldom built now for more than a couple of rowers, as when there are more, provision is usually made for a "coxswain," or steerer, which necessitates an upright stern-post.

Racing-boats range from twelve feet in length upwards; they are built as narrow and with as light a draught as it is possible to obtain, and in order to combine as much strength as can be got, consonant with the lightness, which is indispensable, the very best materials must be used in building them, as the finest pine-wood and mahogany.

These boats are never provided with a keel, nor are they ever what is sometimes called "streak-built," or "clinker-built," both which terms are used to signify that the boards on the side of the boat overlap each other as they ascend, something like the "clap-boarding," or "weather-boarding," of a wooden barn. In the racing-boat the boards are, on the contrary, quite flush or level on the exterior of the vessel, and with a surface as smooth both inside and out as sand-paper and polishing can secure.

The canoe, which has become so popular of late years, is, in the main, a reproduction, or, rather, an imitation of the boat in use amongst various savage and semi-civilized tribes. Of these the fragile canoe of birch-bark, fabricated by our Indians, and afterwards adopted by the French settlers in Canada, represent one modification. In these slight structures the Indian will shoot in safety the many rapids of American rivers. The skin canoes of the Esquimaux are in many respects analogous. Not far dissimilar from these last must have been the light canoes in which our hardy British ancestors pursued their fishing in the deep streams and broad estuaries of ancient Albion. The lineal descendants of those light barks are found to this day in use on the Severn and the Wye, where they are known as "coracles." Gibson, the translator and editor of Camden, thus describes this canoe of the Severn: "The fishermen in these parts use a small thing called a coracle, in which one man being seated will row himself with incredible swiftness with one hand, whilst with the other he manages his net, angle, or other fishing tackle. It is of form almost oval, made of split sally"—(sallow, or willow)—"twigs interwoven, round at the bottom, and on that part which is next the water it is covered with a horse-hide. It is about five feet in length and three in

breadth, and is so light that, coming off the water, they take them up on their backs and carry them home."

The Indians are able in a similar manner to carry their bark canoes round any particularly dangerous or impracticable rapid, at what is called in the *patois* of the Canadian-French a *portage*.

Canoes of the present day are very various in their patterns, as most makers and owners have some special manner of their own in constructing them. The shooting canoe with a flat bottom, in the style of the punt, is the most easy to build. Next to this, perhaps, comes the kind known as the "Rob Roy," from Mr. Macgregor's celebrated little bark. Those provided with sails and shifting keels offer considerably more difficulty in construction. In fact, a good, light, strong, adaptable canoe may fairly be considered a thing which presents many difficulties to the amateur boat-builder.

Amateur boat-building may be said to be one of the most recent forms of unprofessional occupation. Why it should have been so it is hard to say, as much of it does not make a greater claim on the amateur's skill than many other things which he takes up to freely. All that is required is some knowledge of the use of carpenters' or joiners' tools. Of course, few would aspire or hope to make a first-class racing-boat, which is the acme of delicate workmanship, and tasks the best abilities of the professional builder.

There can be little doubt that to the riverside, or sea-shore dweller, who can turn out a decent skiff or other boat in a fairly respectable manner, not only is the pleasure and satisfaction of the successful work great, but the actual money-saving is very considerable.

Some years ago, perhaps, four dollars per foot length might be taken as a rough average of price among boat-builders. Since then materials have risen in price, and the number of good hands in the trade has, perhaps, not increased in a ratio sufficient to keep up with the popular demand for pleasure boats. The result is that prices rule now probably not much less than five dollars per foot on an average. Of course, however, it must be borne in mind that the amateur cannot expect to rival such craft as we have in view, but he can assuredly provide himself with a very good substitute at a very big deduction.

One thing that it is well should be borne in mind is that the amateur may not improbably find himself possessed of some natural "knack" which will stand him in better stead in boat-building than in nine pursuits out of ten, for a reason which will appear as we progress, and in this connection we give a suggestive extract.

"A well-built boat," says a recent writer on the subject, "when in the water seems of itself to suggest life with spontaneous movement; the reason, no doubt, being that the beautiful curved lines which enclose its shape have been more or less adapted from forms that nature has bestowed on living animals. A boat, too, seems to have the separate individuality of a living thing, as all those who have had much to do with ships or boats of any kind will readily allow. Two boats constructed as far as possible on the same model will be found to vary in their 'going' more than would be believed possible by the inexperienced; one, probably, being much more difficult to turn than the other when it has once taken a direction, and in a variety of ways showing what seems almost wilfulness. This seeming inconsistency is probably owing to the extreme subtlety of the ever-changing curves in the form, which, however carefully they may be planned and measured, must at last depend actually upon the eye of the builder, and are consequently subject to variations in common with all true human work."

Like most operations, except the very simplest, boat-building divides itself naturally into two main divisions, viz., those of designing the thing required, and of working out the design. For the purposes of the amateur no great knowledge of drawing is needed. Still it would be a fatal mistake to begin to build a boat without some design on paper to work to—at least, for the amateur. He cannot be expected to possess the "rule-of-thumb" knowledge of the professional workman, and, therefore, the more carefully he designs his ideal craft, and the more minutely he develops the details on paper before beginning the actual building, the more certain he is to attain a satisfactory realization of his hopes.

To aid him in this we will in our next paper enumerate a few simple instruments necessary, and give some details as to the method of producing the preliminary drawings, viz., the "sheer plan" or representation of the boat in profile projection, the cross-sections, and the water-lines.

(To be Continued.)

Decalcomanie.

DECALCOMANIE can be applied to the ornamentation of all kinds of manufactured articles, such as sewing machines, japanned ware, safes, agricultural implements, carriages, sleighs, furniture, pottery, etc. The method of applying is so very simple that it requires little time and skill to become proficient in it. As an art

amusement for ladies nothing has ever been introduced by which such gratifying and pleasing results can be accomplished with so comparatively little trouble and expense.

An entirely new manner of ornamenting (equal to hand-painting) silk, linen, cotton, and other fabrics, suitable for decorating odor bottles, tidies, pin-cushions, lamp shades, sachets, and, in fact, any article made of silk, linen, or cotton, is as follows: Heat a small smoothing iron or a roller used for the purpose, to the usual heat needed for ironing. Then take the transfer and dampen the back of it with a moderately wet sponge. Place the face of the picture on the article at once, lay a thin sheet of paper over it, and press with the iron or roll with the hot roller. Then pull off the paper and the transfer is completed. To make the picture substantial it is necessary to remove the gloss that remains on it when transferred. This is done by again applying the damp paper just drawn off, or, still better, some other damp, water-absorbing paper, and pressing it with the hot iron. The same should be done if the picture does not stick well to the fabric, because the iron was not hot enough or not sufficiently pressed. On the other hand, if the iron is too hot or too much pressure used the paper may stick to the picture. In this case wet it again and it will come off.

Following are the directions for using transfer ornaments: Observe first that pictures showing the colors can only be used on white or very light-colored ground; those that have a covering of white or metal leaf can be used on any color, light or dark. To transfer on glass, porcelain, wood, or any article that is painted or varnished, proceed as follows: Give the picture, that is the side showing the metal or colors, a thin coat of quick-drying varnish, being careful not to go beyond the outlines. Let it remain five or ten minutes until the varnish is right tacky; then place the picture in the proper position on the article it is to be applied to, dampen with a wet sponge, pressing it at the same time, until the paper is thoroughly saturated and adheres smooth. Pull off the paper carefully, and when removed press the picture well with a damp sponge, until every part adheres well; wash it clean to remove the gum, and dry it. To brighten the brilliancy of the colors a light coat of the same varnish may be applied. When the preparations known as cement and detergent are used, it is not necessary to trace the design, as the detergent will remove all the stains. A rubber roller, such as is sold by dealers, is very convenient to press on the picture well, and prevent blisters and uneven places. To apply the pictures to uneven surfaces it is necessary to dampen the paper before laying it on the work. This can be done best by taking two sheets of blotting or other unsized paper, dampen them thoroughly, but don't let any water remain on the surface. When the picture is coated and dry enough lay it between the dampened paper for ten or fifteen minutes. It will then be found soft and pliable, and will easily take the shape of the article. To transfer on paper, a solution of gum arabic, about the consistency of mucilage, is the most practicable. Give the picture a coat of it, and lay it on the surface to be applied to, pressing it well or rolling with the roller. Let it dry for about ten minutes, and then take it off as usual. Remove the gum with a damp sponge, and dry it with a clean piece of linen.

Our Girl's Department.

This department is intended exclusively for "Our Girls," and we hope to make it both interesting and instructive, and to this end we ask our young lady readers to assist by contributions, suggestions, or illustrations. There are thousands of little things that can be, and have been, made and done by young ladies, pertaining to decorative art, needlework, etc., etc., that would be gladly followed but for a want of knowledge on the subject, and we know of no more pleasing task for a lady than that of teaching her younger sisters that which they are anxious to learn, and which may prove of real benefit to them in the future, as well as being useful and interesting for the present. We trust we will have no difficulty in persuading those who have something nice to show or speak of, to make use of this department. Remember, it is open to all, and if you have anything worth knowing suitable for this column, send it along, and we will give it our best attention. Do not be afraid to write because you may fancy your composition is not perfect, or have other scruples of a similar kind. Do the best you can, and leave the rest to the editor of this department, and we are sure you will be pleased with your work.

THERE is but one happiness—duty. There is but one consolation—work. There is but one enjoyment—the beautiful.—*Queen of Roumania.*

— Generosity is the accompaniment of high birth: pity and gratitude are its attendants.—*Corneille.*

— Although men are accused for not knowing their own weakness, yet perhaps as few know their own strength. It is in men as in soils, where sometimes there is a vein of gold which the owner knows not of.—*Swift.*

— She who has no resources of mind is more to be pitied than she who is in want of necessaries for the body; and to be obliged to beg our daily happiness from

others bespeaks a more lamentable poverty than that of her who begs her daily bread.—*Colton.*

—"Almost all the advantages which man possesses above the inferior animals arise from his power of acting in combination with his fellows, and of accomplishing by the united efforts of numbers what could not be accomplished by the detached efforts of individuals."—*J. Stuart Mill.*

—An artistic lamp is in hammered copper, and having the base adorned with a white rose and leaves in silver, with varied oxidations.

—A fancy is shown for using ivory for handles, etc., with the brown outer tint of the tusk retained. It harmonizes well, with representations of the antique in metals.

—Miss Phipps, a pupil of Professor Pitman, at Cincinnati, has taken charge of the instruction in wood-carving at the American Art School in Twenty-third street.

—Stained glass is used effectively in doors at the end of hallways and in those leading into the garden. For drawing-room doors leading into hallways, the upper part is a stationary glass sash, from beneath which hang the curtains.

—Fashionable work-baskets are of twisted straw work, somewhat clumsy in make, and decorated with single silk balls as large as hazel-nuts depending from twisted silk cords. They are usually lined in some bright-colored material, and finished off around the edge with ruching of satin.

—Embroidery upon leather is gaining greatly in favor. The finest kid is usually chosen for this work, and the patterns are the same as for embroidery in satin stitch. The design is traced upon the material, and then small holes are made by a stiletto along the lines, to enable the needle to pass through readily.

—A fashionable foot-stool is a shaggy dog lying in front of a lady's chair, with head alert and fore-paws stretched out. He neither barks nor bites, although of most natural appearance and wearing about his neck a chain; neither does he run away, and although costing $18, is not accounted an expensive beast, considering the insignificant cost of his keeping.

—A very beautiful screen is in three panels of illuminated leather, upon which designs have been painted in oils. The outer panel has a spray of flowering magnolia, the centre one a vase over which conventionalized roses drop in wild profusion, and the last, a bough laden with russet apples. The leather itself is embossed and mounted in a carved mahogany frame.

—The fancy squares sold at the Japanese stores are much used in making lambrequins. They are cut into diamond-shaped pieces, and one point in each is attached to a corresponding point in another, while in the interstices small stars of colored cloth are inserted and caught to the two upper and lower points. To each point a tassel is attached, and the effect is very good indeed.

—If a person wishes to transfer a pattern instead of having it stamped, take a piece of tracing paper and place it over the cloth to be marked, between the cloth and pattern; trace your pattern all over carefully, and you will find the cloth marked. If a person is where they cannot procure the paper they can make it as follows: Take a sheet of writing-paper, not too thin, and rub it all over with warm lard; then pour on lampblack in fine powder, rubbing very smoothly; repeat several times; when all loose powder is removed lay it aside for two days to dry.—S. X.

—A very pretty walking dress is made of dark green repped goods of soft wool. The skirts are attached to a jersey bodice, the front of which is braided in military style in a raised design, which is broad just below the throat, and then narrow-

ing gradually until it reaches a point just below the waist. Here it meets with a wide design in the braiding, which extends from hip to hip. The effect is very becoming to slender figures. The bodice buttons down the back; the close sleeves are braided nearly to the elbow; the skirt is edged with a wide ruche, above which are broad, upright box-plaits, long enough to reach to the scarf of twill, which is draped just beneath the braiding above described.

A lovely tea-gown, representing the genius of Hentenaar, was displayed by a Broadway house a short time ago. Never did a princess out of a fairy story own a more exquisite and dainty robe. It is made of mauve-tinted surah embroidered in silk, with white and blush roses entwined in leaves of palest gold. The back is cut a la Watteau, with a trailing vine of the embroidery reaching from the top of the pleat in the back to the foot of the trained skirt. Around the bottom is a wide ruche formed of four separate strips of pale silk—mauve, white, pale pink and pale gold—fringed on each side to the depth of two inches, and then plaited up together, the whole forming a feathery mass of coloring, matching perfectly every tint seen in the tea-gown itself.

— To apply water colors to steel engravings proceed as follows: First prepare the engravings with a coating of "Newman's preparation for sizing," which may be obtained at any large art dealer's store, at a cost of about sixty cents a bottle. This will harden the surface, so that it will not absorb the color. By all means, however, water colors should be used instead of oil, both for engravings and photographs, though the latter can be colored with oil paints if it is very finely done. In using water colors, use those mixed with Chinese white, which makes them opaque. These can be bought already prepared, under the name of gouache colors, and are much better for painting photographs than the transparent colors. The Egyptian water colors are used a great deal also for such purposes, and are floated on in tints instead of touched in with a brush. A finer finish, however, can be obtained with the gouache colors.

— To make a nice cushion take two pieces of Turkish toweling, cretonne, or patchwork of crazy design a yard long and a half yard wide. Make a cushion of ticking half a yard square; sew the sides of the covering together, except one of the narrow ones; put in the cushion and tie a wide bow of silk or cretonne at the point where the cushion ends. The end left open should be faced or finished with fringe. The whole when completed resembles a bag of meal. This form of a cushion is among the latest novelties. At the exposition held in this city very beautiful ones of this style were exhibited and very much admired. Handsome ones for the parlor are made of silk or satin, with a large monogram worked in the centre. If the slip is of blue satin, the tie is of pink; if of cardinal, it is fastened with olive or old gold.

— The *Art Interchange* says, in giving directions for painting on plush: "If you have a drawing-board of proper size, fasten your plush to it smoothly and evenly by means of thumb tacks, being careful that the silken nap runs downward. Use only a good quality of plush, as it takes the color better, and with a skilful worker needs no other preparation than stroking it smooth with a soft brush. Squeeze the color from your tubes on a piece of blotting-paper, which takes up superfluous oil. It is premised that the outline of your design is already on the plush, so lay on the coat generously to form a firm body for the design. Allow this coat to dry completely, or the after painting may crack. A plush painting will need more than one sitting, as each coat must be thoroughly dry before another is applied. The design should be bold; no two parts should overlap or touch each other. This is the best method, it is claimed, for the best qualities of plush. For inferior plushes without much nap-body, outline your design on the plush, and coat the plush within outlines

of design with gum-arabic solution; let it dry thoroughly, and then proceed to paint as described above."

Floriculture for Girls.—II.

WHILE you wait for May weather—weather befitting the May of the poets, when the ground shall get moist and mellow, the grass green, and the winds warm, and gardening shall seem an inviting pastime—what can you do in preparation for its coming? I think you will find it a pleasant experiment to try starting some seeds (say browallia, pansy, verbena, mignonette, and aster seeds) in the house, in the hope of obtaining early blossoms.

Take, then, a shallow box, and put in it an inch or so of drainage (broken flower-pots make the best); then fill with good soil crumbled finely as possible; get a piece of lath or other flat stick, and with the edge of it mark little trenches for your seed, scatter in rather thinly, and draw the earth over, pressing with the flat side of the lath afterwards to firm the surface; be sure and label each row, so that you can identify them when they come up; water lightly, and set in a sunny window in a temperature not lower than sixty degrees.

When the seedlings have formed their second leaves, thin out, and plant those you remove in a box like the first. This thinning out requires great care. The roots of the plants not moved must be disturbed as little as possible, and those taken out must not be left with roots exposed longer than can be helped, and must be handled very gently when replanted. When you press the soil round them take care not to pinch the little stems, or you may unwittingly destroy half your young family, and wonder, when you presently see them withering, what has happened to them. After transplanting, shade from the sun for a day or two until they seem to be growing again.

By the middle of May it will be safe to plant seeds in the garden, and if you have saved half your seeds for out-of-door sowing, it will interest you to see how, under the influence of the warm spring sun, they seem trying to catch up with their earlier-planted associates.

Now equip yourselves for work "in the garden," and to that end procure a hoe, a rake, a trowel, some pointed sticks, and a watering-pot. If all of you had big rubber aprons which reached below your knees, and on which you could kneel when necessary, it would be a useful addition to your outfit.

The field is before you. It may be a back yard in the city, or a lovely garden in the suburbs, or a margin of the vegetable garden allowed you, in the country. Whatever it is, I hope the soil has been well dug, and hoed, and laid open to the sun, and that *you have assisted* at the operation. Now you may have house-plants to bed out, and seedlings to set out, and seeds to sow, and the questions arise, Which? and Where? In this the taste of the plants must be consulted as far as your circumstances will allow, for one calls for sun, and another for shade, and a third for moisture, and will not be denied without sulking. Using, then, your best discretion in placing them, you proceed first to set out your house-plants. They have been watered well over night, and all straggling branches and weakly shoots have been cut off (by a slanting cut with a sharp knife). Holding a pot upside down, with the stem of the plant between your fingers, tap it sharply and lightly against a wall, or with the handle of your trowel, so that the soil is loosened from the sides, and draw off the pot with your other hand. Do not crumble off the earth from the roots, unless it is mouldy. Set the plant in a hole dug for it, and settle the earth firmly round it with your hands; then rake the bed thoroughly and water, and leave to summer's care until the usurping weeds appear and you are summoned "to the rescue." Always keep your beds well weeded; you will take twice the pleasure in them that you could possibly get from half-raked, slovenly-looking borders.

With your seedlings be careful. Lift them from their box, with plenty of soil

round their roots, into little horns of paper, and carefully slip from these into the place prepared for them; plant some distance apart, to allow for growth; gently press the earth down round them, and lightly rake over the border, water, and shade for a day or two with papers or matting, until the plants have taken root, which you can generally tell by their beginning to put out new leaves.

In planting *seeds* you must have a mental view of the plants they will make; here you see how your taste and imagination is appealed to. You must avoid planting low-growing varieties where they will be hidden by tall ones, and be sure of having agreeing colors next each other. Put labels by each kind of seed you sow; here the pointed sticks come in. Now keep a watchful eye for stray cats and chickens, and dogs with bones to bury; none of these creatures feel any compunction at uprooting your choicest seedlings, and undermining your favorite plants, and scattering your carefully-planted seeds.

After your garden is once planted, your work will be to keep the weeds at bay, and water when the dews and rains forget to visit you. As the plants grow, a little amputation will not hurt them; if you take off here and there a straggling stalk, and pinch off buds that appear in the wrong places, you will have a family of well-shaped plants, not a deformed or crippled one amongst them.

Let me give you a list of flowers of an accommodating disposition, that will grow with the very smallest encouragement. The following comprise a good range of colors: Phlox drummondi, portulacca, dianthus heddewiggi (Indian pink), pansy, browallia, mignonette, and sweet alyssum; and for climbers, sweet pea, maurandia, and nasturtium. These are a very few from the very many that may be grown in an ordinary garden-lot, but enough to experiment on, and enough to afford you much delight, if, as they are likely to do, they flourish under your care.

Bulbs planted last autumn should be blooming now, and I hope you will remember them next fall, so that you may have them to brighten the garden while the seeds are just starting, and to help you wait with patience for the summer flowers. Hyacinths, tulips, and narcissi should make your borders gay, and crocuses and snowdrops come up through the grass-plot, or cluster under trees, or in any place where a bit of spring brightness would be most appreciated.

I cannot, in one little talk, tell you more than the very initiatory steps to the growing of flowers, and all I could say would still leave you the greater part to discover by experience; but if you will bring what Nature has given you of enthusiasm, patience, and common sense to bear on your experiments, I am not afraid that you will fail of good results. Good speed to you in your gardening!

NELLIE HOOPER.

The Stephanoceros.

BY MARY H. WHEELER.

The microscope is on the stand,
  The lighted lamp in place;
With slender forceps in my hand
  I draw from out its case
A tiny water-milfoil spray,
  Of lovely, verdant tint,
And focusing the usual way,
  Look down the tube asquint.

"What do I see?" A cell-built leaf,
  With thorny apex crowned;
But what is that long hairy sheaf
  Attached to something round?
Round, did I say? 'Tis oval now,
  And shining like a gem;
And fastened to the leaf somehow
  By something like a stem.

The stem grows longer. See, O see!
  What is the thing about?
The hairs spread fanlike; can it be
  'Tis turning inside out?
There now it lies, a form complete,
  With five long arms spread wide;
And mark that organ's steady beat
  In its transparent side.

The arms have formed a cup, you see,
  The long hairs meet and cross.
Ah, now I know it must, must be
  A Stephanoceros.
O King of Animalculæ!—
  For surely thou art crowned—
Long vainly have I sought for thee,
  But now you're found! you're found!

Pittsfield, N. H.

THE

Young Scientist.

A Practical Journal for Amateurs.

(With which are incorporated "THE TECHNOLOGIST," "THE INDUSTRIAL MONTHLY," and "HOME ARTS.")

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A Danger and Its Remedy.

A RECENT issue of the *London Lancet* contains a long warning in regard to the toy known as the "puff and dart." The toy is a very old one, and consists of a long tube, through which a dart or pellet is forcibly propelled by the breath. The *Lancet* claims that practice does not diminish the danger which attends its use, for which assertion the following reasons are given:

"A deep breath must be drawn before blowing into the tube, and it is extremely likely that this will not be concluded when the tube reaches the mouth in the act of applying it quickly. Again, any person may be seized with a fit of coughing on the first effort to expire, and the dart is, under these circumstances, extremely likely to be drawn into the mouth, and to pass into the larynx. If it does so enter, it is probable that it will go far in, as the worsted padding will form a soft plug; and the needle-point being outwards, the next expiratory effort is almost sure to drive it into the wall of the larynx or bronchial tube, rendering extraction exceedingly difficult, if not altogether impracticable. In two of the cases which Dr. Bruce has described death ensued after much suffering. It is a peculiarly melancholy and distressing death to die, this slow killing by a foreign body in the lung, and the distress of patient and friends is necessarily greatly enhanced by the reflection that the pain and loss of life have been the results of recklessness. Surely, such toys as this apparatus of 'puff and dart' ought not to be sold to children, and should be abandoned by adults. The ordinary pea-shooter is a foolish instrument of the same class, though not, of course, so deadly in case of accident, as the pea is small and round, and may be coughed up; but there are cases on record in which even so small a body as a pea has caused death by being gradually drawn into a small bronchial tube, where it has acted as a 'pea valve,' passing a little further in with each deep or prolonged inspiration, until the air has been wholly pumped out of the lung behind it; and disease has been set up in consequence, partly by its pneumatic effects on the organ, and partly by the irritation and inflammation its presence has set up. Life is sufficiently beset with perils which are unavoidable. It is needless to make new dangers, and it is particularly silly to do so when there is really very little, if any, amusement to be got out of the diversion to which the peril is attached. We trust the perils of 'puff and dart' may be made extensively known by our readers, and that the foolish game, with its dangerous apparatus, may quickly fall into disrepute, as it is not worth the risk run."

That the *Lancet* does not exaggerate the danger of "puff and dart" we fully believe, but as it will be almost impossible to abolish the use of this toy, we would suggest that all manufacturers and dealers should be compelled to place cross wires in the end of the tube next the mouth. In this way a free passage may be secured for the propelling air, while there can be no danger of the dart passing backwards into the lungs.

Those of our readers who may have occasion to write to advertisers for circulars, samples, or other information, will do us a great favor, and advance the interests of the YOUNG SCIENTIST, by mentioning our paper.

The good work goes on apace. Every day adds new names to our list, and thus the circle grows larger. We are never tired of receiving new names, new autographs, new friends. All are welcome to our ranks, and we trust that each one whose name we have now entered on our

books will induce some friend, brother, sister, or near relative to join our ranks. Every new-comer adds to our power to make the paper better, and, if possible, more complete. By January 1st, 1884, we want 25,000 new subscribers, and when this occurs the paper will be made larger, without change of price.

Cheerfulness is an absolute necessity to healthy young people, and to all people, for that matter, who desire to be healthy. True, cheerfulness, in a great measure, depends somewhat on the temperament of the person, as well as grace and a good healthy conscience. Boys and girls should always be cheerful, always good-natured. The little troubles, disappointments, and adversities that beset the ordinary course of a boy's or girl's life, are but evanescent, and to-morrow's sun will disperse them as it does the morning's mist. To be cheerful is to be happy, and happiness should be the constant companion of youthfulness.

Articles on any subject connected with amateur science or work will be gladly received from any of our readers, and any suggestions offered will be duly considered. The Young Scientist was ushered into existence from a sincere desire to benefit and assist young people in the acquisition of scientific knowledge and mechanical expertness; and to this end we have made arrangements that enable us to assure our readers that there will be no paucity of articles in the forthcoming numbers on the following subjects: Astronomy, Natural History, Botany, Floriculture, Practical Mechanics, Decoration, Acoustics, Hydrostatics, Pneumatics, Heat, Light, Magnetism, Electricity, Gases, Matter, Force, Motion, Ornithology, Zoology, Entomology, Geology, Photography, Pyrotechnics, Paper Flower Making, Joinery, Cabinet-Making, Wood-Engraving, Wood-Carving, Modelling in Clay, Painting, Drawing, Etching, Painting on Glass, Experimental Chemistry, etc. Notwithstanding the fact that these arrangements have been made, we would prefer that our younger readers would write us their experience—trials, failures and successes—on the various studies they may be engaged in. Young people like to know of other young people's doings, and are more likely to be encouraged by the successes of their amateur contemporaries than by the successes of experts. Taking this view of the matter, we earnestly ask our readers to make known their experiences through our columns, not only for the benefit of their fellow-readers, but also for their own edification, a result which is sure to follow a careful analysis of their own doings.

There never was a time in the history of the world when so many able men evinced such a strong desire for progress and advancement as at present, and the old Latin proverb, "*Bos optat ephippia*," may now in truth be applied to the majority of those who toil with hand or brain; for the mechanic seeks to acquire the theoretical knowledge of the brain-worker, while the latter longs to be possessed of the manual skill of the former. The amateur and the skilled worker alike desire to know the why and wherefore; the one to gain a shorter road to excellence, and the other to assist his manual skill by technical knowledge, and thereby enable him to add to his earnings. On the other hand, the clerk, the banker, the student, and the man of letters, who may be well up in theory, and who know why this, that, and the other are, and should be done, and who can offer useful theoretical suggestions, feel a want of practical knowledge, and are therefore anxious to make themselves familiar with the various manipulations and operations as performed in the numerous trades. To these searchers after knowledge the Young Scientist offers special opportunities for finding what they seek, as the range of subjects discussed is extensive, and, in a measure, complete. That a journal of practical instruction in mechanical and scientific matters, adapted to the requirements of amateurs, is a popular want, there is more than sufficient evidence to show by the letters received at this office commending our "new departure," and

filled with words of encouragement and good wishes for our future success. We are thankful for these evidences of good-will, and shall, in the days to come, endeavor not only to retain the good opinion of our readers, but to increase its intensity and enlarge its area.

One of the greatest indications of the development of American mechanical genius rests on the fact that since the introduction of foot-power scroll-saws in 1874, no fewer than 250,000 of these machines have been made and sold, of various grades and prices, ranging from $2 for the wooden-frame saw, to $30, and even $40, for the more complete and perfect saw, with light iron frame and steel works. To supply these saws with blades would require something like 250,000,000, figures that seem enormous at first sight, but when we consider that each saw frame in use for a few years will use up several gross, owing to their liability to break, or become dull and worthless with little use, the number manufactured is simply amazing. A reporter who visited a dealer in saws, blades, designs, and fancy woods recently, was told that "there is an increasing interest in scroll-saw work, and judging from appearances and demand, there is no sign of the business slacking up." When asked if it was not possible that designs for sawing might be exhausted or become too intricate, he was told "that intricacy of design is no obstacle, but rather in favor of the business, as sawyers are becoming so expert that what a few years ago seemed impractical designs, from their intricacy, are now very ordinary affairs, and are cut almost daily by novices in the art. There are at least a dozen different designs for almost every subject you can think of—bird-cages, music-racks, writing-desks, picture-frames, work-boxes, shrines, cloak-cases, flower-pots, brackets and match-safes. These are not a tenth of the subjects. We sell, I should say, over 500 patterns a year, besides a number of scroll-sawyers' manuals." "Who does all this scroll-sawing?" asked the reporter. "Principally boys, although there are a great many business men who engage in it as a pastime. One of my customers is a married man, whose wife prepares his work for him during the day. Another was a high-school boy, whose sister did everything except to saw out the design. Then, again, ladies have been so infatuated with the work that they have done a great deal of it, especially the inlaying, which requires considerable skill." Many of the saws now in the market are models of constructive genius, being built so as to produce the best results with a minimum of materials, labor and expense. The more expensive saws have various attachments, such as circular saws, turning lathes, rotary moulders, boring machines, and inlaying appliances, all of which tend to give the machine more range and to enhance its value.

Astronomy for Amateurs.—May.

BY BERLIN H. WRIGHT.

TOTAL ECLIPSE OF THE SUN, MAY 6.

The Sun will be totally eclipsed on the 6th of May. The width of the path of totality of this eclipse will be unusually great, and the partial phase will be visible over a very great area; still, very few civilized people will behold it, as the favored region is in the Southern Pacific ocean. The savages will beat their tomtoms, and resort to their customary practices to propitiate their angered god, that he may cause

Fig. 1.—TOTAL SOLAR ECLIPSE.

the light of day to again appear. The path of totality extends from a point in the Pacific ocean off the west coast of South America, in lat. 12° south; long. 87° west of Greenwich, through the Marquesas Islands; thence through the Friendly Islands, passing north of the Paumotu, Society and Hervey Islands, and south of the Fiji and Loyalty Islands and New Caledonia, terminating upon the west in lat. 35° south; long. 157° east of Greenwich.

The northern line of limitation passes from near New Ireland, northeast of New Guinea, through the southern portion of the Marshall Group and the Sandwich Islands, touching the southern extremity of the peninsula of California, crossing Southern Mexico and Yucatan. A very small partial eclipse will be visible along

the coast of Peru, Ecuador and Colombia, and throughout Panama and Central America.

The most thickly populated portion of Australia will be favored with a very small eclipse just after sunrise, the limiting line (where the eclipse ends at sunrise) passing about midway between Adelaide and Melbourne. As the path of total eclipse passes over no favorable point, but little effort will be made to secure observations; still, one or two small expeditions have set out for some of the "South Sea Islands."

Inasmuch as the Moon moves from west to east in its orbit, its shadow must pass from west to east over the earth.

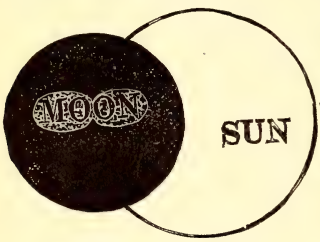


Fig. 2.

Fig. 3.

Fig. 4.

The Moon produces a total, partial or annular eclipse of the Sun whenever she passes within 17° of one of her nodes at the time of New Moon, and if this event occurs at the time of perigee, a total eclipse occurs, for then the Moon's umbra, which is only about 234,000 miles long, touches the earth. The nearer the Moon is to the earth the wider will be the belt of totality and the greater its duration, because the diameter of the umbra will be greater. If the Moon reaches her node exactly at the time of conjunction, i.e., directly in a line between the earth and Sun, at the time of Apogee, then an annular eclipse occurs, because the apparent diameter of the Moon is less than that of the Sun (see Fig. 4), and when at perigee, or nearest the earth, then the eclipse must be total, for then the apparent diameter of the Moon is equal to or exceeds that of the Sun. But when the conjunction occurs *near* the node, a partial eclipse must occur, cutting off (Figs. 2 and 5) only a portion of the Sun's limb. And the further from the node, inside of the solar ecliptic limit, 17°, on each side of the node, or 34°, the Moon is, the smaller will the eclipse be. The period occupied by the Moon in passing over this portion of her orbit may be called, for convenience sake, the eclipse season, which is of about twenty days duration. Fig. 5 represents the equator of the heavens, C D; the earth's path, F G, and the path described by the Moon's nodes, E H. It is evident that eclipses can only occur at a limited distance each side of A and B, the two nodes, or from *a* to *b* on each side of A.

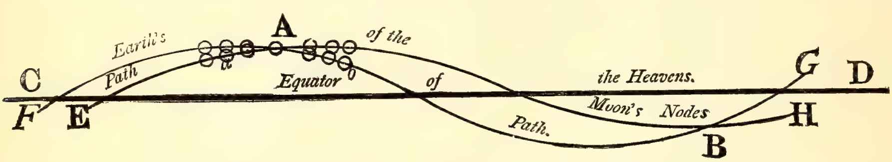


Fig. 5

It must be remembered, in this connection, that the *Sun's apparent* path through the heavens is the *earth's true* path.

THE PLANETS.—MAY, 1883.

(All Computations are for the Latitude and Meridian of New York City.)

MERCURY AND JUPITER.

These planets are evening stars, Mercury being the most western, Jupiter being about one hour or 15° east of Mercury. They set as follows:

MERCURY.

May 10—8h. 55m., 33° 16′ N. of west point, and 9° 40′ N. of sunset point.

May 15—9h. 2m., 33° 55′ N. of west point, and 7° 59′ N. of sunset point.

May 20—8h. 58m., 33° 29′ N. of west point, and 6° 38′ N. of sunset point.

JUPITER.

May 10—10h. 21m. eve.
" 20— 9h. 51m. "
" 30— 9h. 20m. "

The following are the only phenomena of interest, transpiring at a seasonable hour, that are visible:

Sat.	*D.*	*H.*	*M.*	*Phenomena.*
I.	5	8	13	Transit, ingress.
I.	6	8	43	Eclipse, reap.
IV.	7	8	2	Occult., disap.
IV.	7	9	45	Occult., reap.
II.	7	9	51	Transit, egress.
II.	16	8	29	Eclipse, reap.
III.	20	8	22	Occult, "
III.	20	8	22.1	Eclipse, disap.
I.	21	9	1	Transit, egress.
I.	28	8	45	" ingress.

It will be interesting to see Sat. III. appear from an occulation on the 20th, at 8.22 eve., and six seconds later plunge into Jupiter's shadow.

Saturn is too close to the Sun to be seen.

Venus and *Mars* approach within three-fourths of one degree of each other on the 10th, Venus being the most southern. They will be situated at that time exactly in the middle of the constellation Aquarius, with no stars brighter than of the fourth magnitude within 20° of them. The Moon passes about 4° north of them on the morning of the 4th. They rise as follows:

VENUS.	MARS.
May 10—3.32 morn.	May 10—3.29 morn.
" 20—3.21 "	" 20—3.8 "
" 30—3.11 "	" 30—2.56 "

Uranus passes the meridian on the 5th at 8.28 eve.; 25th, 7.9 eve.

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS, MAY 22, 1883.

	H.	*M.*	
Alpha Andromeda (Alpheratz) rises	0	13	mor.
Omicron Ceti (Mira) variable, "	4	27	"
Beta Persei (Algol) " "	1	53	"
" " sets	8	8	eve.
Eta Tauri (Alcyone or Light of Pleiades) rises	4	13	mor.
Alpha Tauri (Aldebaran) rises	5	32	"
" " sets	7	26	eve.
Alpha Aurigæ (Capella) rises	3	0	mor.
" " sets	11	15	eve.
Beta Orionis (Rigel) invisible.			
Alpha Orionis (Betelguese) sets	8	13	"
Alpha Canis Majoris (Sirius or Dog Star) invisible.			
Alpha Canis Minoris (Procyon) sets	9	51	"
Alpha Leonis (Regulus) sets	0	48	mor.
Alpha Virginis (Spica) in merid.	9	18	eve.
Alpha Bootis (Arcturus) "	10	9	"
Alpha Scorpionis (Antares) in meridian	0	24	mor.
Alpha Lyrae (Vega) in meridian	2	35	"
Alpha Aquillae (Altair) rises	9	14	eve.
Alpha Cygni (Deneb) in meridian	4	39	mor.
Alpha Pisces Australis (Fomalhaut) rises	2	53	"

Penn Yan, Yates Co., N. Y.

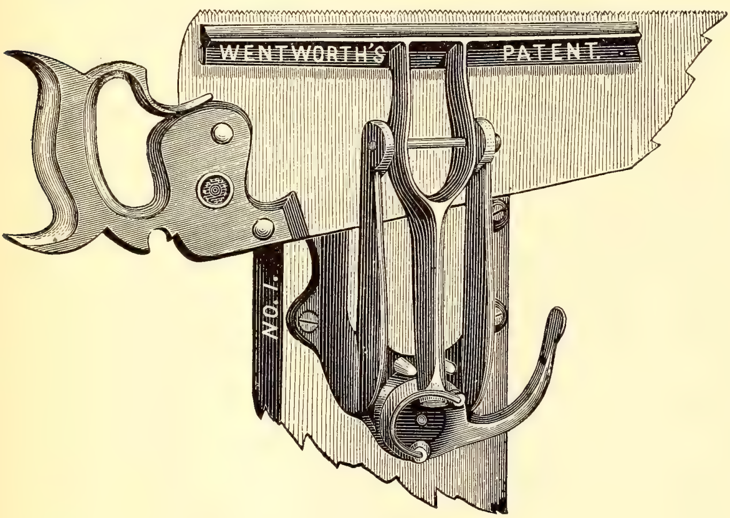
A Tailless Kite.

This is the time of kite-flying, and the boys are ready for any novelty that will add zest to the sport. A number of years ago some gentlemen of Rochester discovered in a book of designs printed in Holland a drawing of a kite which should float in the air without the necessity of a tail balance. One of the gentlemen constructed one, and when he displayed it to his incredulous friends they derided his assurances that there was go in it, and he would make it go. The first attempt was a failure. Indeed, if the kite doesn't rise on the first sufficient gust of wind, it should be discarded and a second kite made. The second attempt was a decided success, so much so that as the erratic thing cavorted beneath the empyrean everybody wondered what strange creature of the air it might be. Recently another one of these singular-looking flyers was put up, and it would have done one good to have seen how delighted the boys of twenty or thirty years old were as the tailless kite soared away into the blue depths, now plunging eccentrically towards contiguous dwellings and again gracefully swimming up towards the zenith. It is intimated that tailless kite-flying will be *the* popular amusement this season. For those who desire to try a hand at the novelty, we give brief directions as to construction. The shape of the kite is what the boys call "diamond." The cross-bar, which in a tail kite of the diamond pattern is straight, should be made of hickory and bowed by connecting the ends with a taut string. It should then be placed at right angles with the perpendicular stick and fastened securely, the bend of the bow being backward from the intersection of the sticks. Run a string around over the end of each stick, and cover the frame with light tissue-paper. For a four-foot kite, the perpendicular stick should extend three feet below the point of intersection with the bow, and one foot above it. The bow should be one and one-half feet long on each side of the point of intersection with the perpendicular stick. The belly cord should be united at the point of intersection, and at the same distance down the perpendicular stick as the arms of the bow extend on each side of the perpendicular stick. The band is attached at only two points, the point of intersection and at a point below, in the four-foot kite mentioned, one and one-half feet below the point of intersection. Tie these two strings together, and attach the captive cord, balancing it so that the captive cord shall be exactly opposite the point of intersection, or at right angles with the perpendicular stick frame. The face of the kite is then convex, and the back, of course, concave.

If at first you don't succeed, try again. It is a fun for all sorts of boys. This form of kite is sometimes very eccentric, and as game as a wily fish.

Novelties for Amateurs.

Among the new things we intend talking about this month is the new Wentworth saw-clamp, made by the Seneca Falls Manufacturing Company, Seneca Falls, N. Y. This is an excellent device for holding a saw while being filed, and is particularly adapted for the use of amateurs, as it is simple, durable, and easily handled. The saw can be placed in the grips or jaws almost instantaneously and as readily removed, and may be slipped forward or backwards in a moment, at the will of the operator. The annexed illustration exhibits the device, and will give the reader some idea of the working and character of the tool. In the cut the saw is shown in position, gripped tight and ready for filing. The clamp is attached to the side of a work-bench, table, or side of a wall below a window, by means of strong screws, and it may readily be taken away if not convenient to leave permanently in position.



The clamp is worked by means of a cam, to which a lever is attached, all of which is shown on the lower part of the cut. The cam attachment is convenient and handy to work, and is as efficient as it is simple.

To Transfer Printed Matter to Glass.

Flow the glass-plates with a good quality of photographers' negative varnish, which should be thinned down in the usual way. When this has been partially dried so that it will not run into the paper, lay the engraving or show-bill face downwards upon the prepared surface, and subject it to a slight and uniformly apportioned pressure for twenty-four hours. Then moisten the back of the paper, and by means of a soft rubber, rub off the softened paper. If this is done with care, the ink lines will remain attached to the varnished glass surface. As the thin varnish is quite transparent, this is equivalent to transferring the engraving to the glass surface. The transfer is frequently improved in appearance by giving the plate (and transfer) a second coat of varnish.

Scientific News.

—The reappearance of the Star of Bethlehem is predicted by astronomers for this year or the next. On the 11th of November, 1572, Tycho de Brahe discovered a star in Cassiopeia which equalled Sirius, and even Venus, in brightness for a month, and then fell back into its former insignificance. Conjecture has sought to establish a connection between this phenomenon and two similar apparitions in 1264 and 945. A not unnatural inference was that the same increase in volume of this remarkable star occurred before 945, which would bring us to about 630 and 310 and to the date of the Nativity. This star is now again due.

—Nothing can be worse for a child than to be frightened. The effects of the scare it is slow to recover from; they remain (sometimes) until maturity, as is shown by many instances of morbid sensitiveness and excessive nervousness. Not unfrequently fear is employed as a means of discipline. Children are controlled by being made to believe that something terrible will happen to them and punished by being shut up in dark rooms, or by being put in places they stand in dread of. No one without vivid memory of his own childhood, can comprehend how entirely cruel such things are. We have often heard grown persons tell of the suffering they have endured, as children, under like circumstances, and recount the irreparable injury which they

are sure they then received. No parent, no nurse, capable of alarming the young, is fitted for her position. Children, as nearly as possible, should be trained not to know the sense of fear, which, above everything else, is to be feared in their education, early and late.

—The records of industrial progress nowadays read not unlike what the English laureate once termed "fairy tales of science." There seem to be no limits to the transformations which material products undergo at the hands of the modern scientist. These remarks are suggested by the very suggestive title of a book lately published, "The History of a Lump of Coal from the Pit's Mouth to a Bonnet Ribbon." The alchemic power of science, even if it does not transmute whatever it touches into gold, yet, by means of judicious separations and combinations of elements formerly regarded as useless, can so increase the value of products that its effects fall little short of those dreamed of by the magicians of the Middle Ages. It is implied in what has been said above that the influence of scientific research upon industrial methods is growing more marked with each succeeding year. This state of affairs is now generally recognized and was alluded to by Dr. Siemens in his address as President of the British Association, who declared that the advancement of the last fifty years has rendered theory and practice so interdependent that an intimate union between them is a matter of absolute necessity for our future progress.

Notes and Queries.

In continuing this department, which has been found of so much value, we would remind our readers who wish for information on any of the arts and sciences, that they are cordially invited to make their wants known through this column, and those of them who can furnish accurate answers to questions asked are requested to send in replies. Doubtless many of our subscribers may know of methods, processes, or devices that may be better or more suitable for the particular case in question than anything generally known, and it is this reason that induces us to keep this department open for a medium, where an interchange of ideas and practices may be made to the advantage of all our readers. Correspondents will please send their full address when forwarding their communications—either questions or answers—not for publication, unless expressly so stated, but so that we may know where to find the writer if desirable. Communications should be sent in on or before the first of each month previous to publication, to insure insertion in next issue.

Answers.

57. Parlor Plants.—In reply to Ida, I beg leave to submit the following hints and suggestions:

In growing plants in the house we must first bear in mind that not every plant is suitable for such culture.

First, there is no better plant than *Abutilon striatum.* It grows freely, is not troubled by insects, and is always in bloom. The gaily-colored bells are very pretty.

Next, the Calla-Lily, so called, though not botanically a lily, will grow well and give a profusion of bloom. Give it plenty of pot room, let it grow very large, allowing all the suckers to remain, and give plenty of water. We have seen plants, thus treated, with a dozen flowers each.

Chinese Primroses are very easily grown and flower freely. They should have light, rich soil, and the pots should be well drained, for if the soil becomes sodden the plants never flourish.

Cyclamen do well with window culture. The soil should be rich, and the plants once started into growth should never suffer for want of moisture.

The Monthly and Sanguina Roses, so seldom seen now, are the best for the parlor; a very double rose fails to open its buds. Roses brought directly from the green-house to the parlor seldom do well.

The winter-blooming Fuchsias, *speciosa* and *serratifolia*, are capital window plants, and are always in bloom.

Daisies and Violets seldom do well in the parlor; the air is too hot and dry for them, and they are very subject to the attacks of green fly.

Of Geraniums the Zonale or Horseshoe varieties are the best. They give little bloom until after the short days, but when they once begin to flower are seldom out of bloom. The species with sweet-scented foliage are worth growing, but the flowers are insignificant.

Of Ferns, the best for the parlor is *Pteris tremula*, the next *Adiantum cuneatum.* These ferns will withstand both gas and furnace heat, and are always beautiful.

One great secret in growing plants well is to *water thoroughly.* Few plants, unless in a very dry position, need water every day; but when watered the soil should be saturated; the superfluous water should be allowed to drain off, for there is scarcely a plant (Calla-Lily excepting) that flourishes if water remains on the roots.

Attention should be given to washing the foliage, for a plant breathes through the leaves, and if the pores are stopped with dust the plant suffers.

The temperature of water used for plants should be that of the room in which they are growing—warmer if you please, but not colder. A plant is a living being; its wants are few, but careful attention to these is essential to its health and beauty.—Flora.

58. Cleaning Kid Gloves.—If Katie B. will try the following, I think she will be quite satisfied. For a temporary cleaning, when the gloves are required for use in a few minutes, the easiest way is to take a piece of white flannel, dip it in milk, rub over it a piece of white soap, and then with this rub the soiled parts of the gloves. The advantage of this process is that the gloves can be worn ten minutes after having been cleaned; but the disadvantage is that the threads of the seams remain dirty. Benzine is better in this respect, and makes everything about the glove perfectly clean, as it dissolves all greasy dirt. It may be used in the same way as the milk above described, or as is done by those who make kid-glove cleaning a regular business. The gloves are put into a large glass-stoppered bottle, and shaken up with the benzine; in a short time the benzine will have dissolved all the dirt, is poured off, the gloves wrung out and dried on a hot plate; otherwise they will for a long time afterward smell of the benzine. The benzine used for cleaning may be recovered again in a clean condition by distilling at a low heat.—Boston Girl.

59. Wood-Polishing.—"Big Boy" will not be able to do good work in polishing wood until he has had some practice in the matter. He should first try his hand on some prepared pieces of wood, and not attempt to finish constructed work until he is satisfied with the experiments. Walnut or similar woods are best finished with fine glass-paper, No. 0; then color linseed oil with alkanet root and rub into the wood, and afterward let it stand for a time until the oil has thoroughly soaked in; then proceed to fill the pores with a composition of plaster of Paris, three parts, tallow one, and a little red polish. This is to be thoroughly worked until it is mixed and becomes a crumbly mass. It can be rubbed into

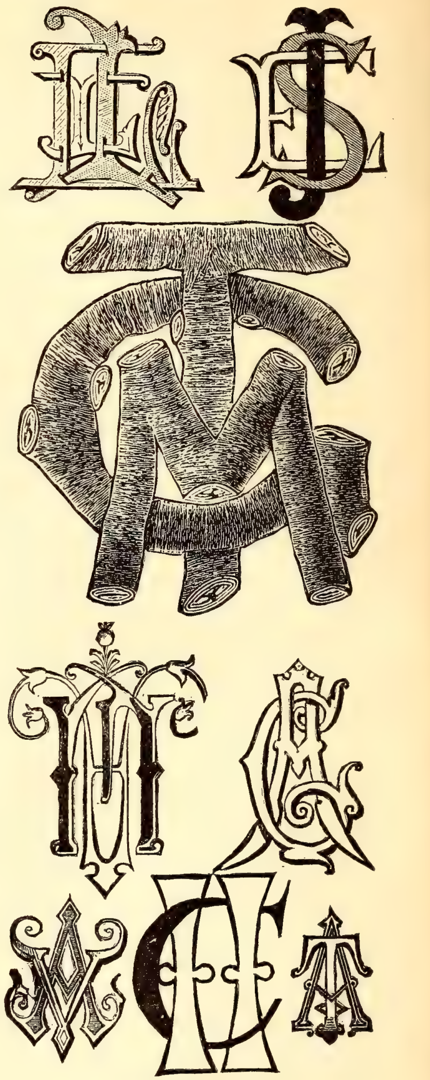
the wood with a piece of rag, after which all the superfluous parts are removed, and the surface is ready for the final polish, which may be put on with a brush, or after the French method—with a tampon; in the latter case only shellac dissolved in alcohol is used. With the brush you can use any kind of varnish. Soft woods may be turned so smooth as to require no other polish than that which can be given by holding fine shavings of the same wood against them in the lathe. For polishing mahogany, walnut, and some other woods, the following formula is given: Dissolve beeswax by heat in spirits of turpentine until the mixture becomes viscid. Apply with a clean cloth, and rub thoroughly with another flannel or cloth. Beeswax is sometimes alone used. For work in position, it must be melted and applied and rubbed as above. For work in the lathe, it can be applied by friction, the slight amount of wax melted being sufficient for the polish. The work should be thoroughly rubbed. Mahogany may be polished by rubbing first with linseed oil, and then by a cloth dipped in a very fine brick dust. Some hard woods have a natural polish, and do not require a polishing medium. A fine gloss can be produced by rubbing with linseed oil, and then holding shavings or turnings of the same material against the work in the lathe. A very perfect surface can be obtained with glass-paper, which, if followed by hard rubbing, will give a beautiful lustre. Lustre can also be given to carefully finished surfaces by applying a small quantity of thinned varnish, shellac or "fillers," by a cloth, and carefully and thoroughly rubbing. Part of the above is taken from "Comstock's Interior Details," and may be relied upon as being perfectly practicable.—Red Cedar.

60. Grindstone.—For turning up a grindstone the usual plan adopted by professional workmen is the following: Take a piece of sheet-iron, and secure it firmly upon the trough or frame (by hand or otherwise), close the grindstone. Let this one run gently towards the iron, which, of course, must be pushed on as it wears off. You will soon obtain, in more or less time, according to the state of the stone, a perfect, true, and level surface. If your grindstone is much out of true, you had better begin to bite the humps, by hollowing grooves with the sharp end of an old saw-file, secured as above.—"Our Ned."

61. Embroidered Monograms.—If Bella S. will give her correct initials, and state for what purpose she wants designs of monograms in embroidered work, I will, perhaps, be able to help her out somewhat, as I have a number of monograms suitable for needlework.—Lizzie.

62. Needle-Case.—In making a needle-case with shells procure a pair of the American fresh-water mussel shells *(Anadon fluviatilis)*, a full account of which may be found in the February number of the Young Scientist of 1881. See that the shells are the same size; perforate nine small holes round the front of the top one, at equal distances, about half an inch from the front, and two more at the top part of both shells. Take a narrow piece of sarcenet ribbon, put one end into the left hand hole and fasten it there, then over the front of the shell, under, and through the second hole, so on to the last, and fasten it off. Cut out two pieces of fine white flannel a little less, and also the form of the shell, bind it round with the same blue ribbon; put these inside, and with another piece tie them together through the four holes at the top in a neat little bow. For the strings in the front, take some more of the same blue ribbon, and, after fastening to each shell, tie together in a little larger bow.—X.

63. Monograms.—The annexed monograms of E. S. G., T. M. G., L. L. L., A. L. L., A. C., A. T., V. A., and C. H., have been received from various points. A number of other monograms have also been received from various parties, some of which were good enough to publish, but for which we cannot afford space in this issue, but may in future numbers.



Queries.

64. Oil Colors.—I desire to paint a few plaques in oil colors, the subjects to be flowers. Can you inform me where I can obtain designs or outlines for flowers, particularly of daisies? If you please, I would also like to know about the cost of same. —Katie B.

65. Steamboats.—Were steamboats ever patented? and if so, when?—"Big Boy."

66. The End of the World.—How many times has the "end of the world" been predicted by men of more or less weight? Are there any such doleful predictions hanging over us now?—Musical.

67. Painting Photographs.—Will you kindly inform me what colors are employed in painting photographs in water colors?—Thirza McB.

68. Glass.—Is it known that the Hebrews, when they first settled in Palestine, understood the manufacture and use of glass? Was the use of glass pretty well known among the ancients?—Curious.

69. Monograms.—Our readers who have the time and ability to construct monograms are invited to send in designs for the following combinations: G. B., M. D. H., L. F. R., E. H. H., W. A., W. W., M. G. T., and G. E. T. Contributors to this column are requested to send in their communications before the first of the month preceding the date of issue.

70. Aquaria.—Will some reader please inform me what fish and other animals and marine plants are best to start an aquarium with?—O. J. L., of Philadelphia.

Note.—Our correspondent is not very clear; he does not state whether he wants a sea-water or fresh-water aquarium. The following general suggestions are offered, however: We would advise about one bunch of plants to every three gallons of water, and three *small* fishes to each gallon of water. By a bunch of plants is meant such as is sold by the dealers. Valisneria is recommended above all other plants for the purpose; the rivers are full of this growth. Nitella, anacharis, and utricularia are also excellent plants for the purpose. In the matter of fish, try catfish preperel, shiners, dace, minnows, rockfish, sunfish, and tadpoles, all as small as can be obtained. Apply to Mr. Taxis, of your city, for further information; he is an expert in these matters, and you will find him a gentleman in every respect.

Market Report.

Retail Prices.

IMPORTED CAGE BIRDS.

Canaries, *Belgian*, per pair	$6.00 to 15.00
" *French*, per pair	6.00 to 15.00
" *German, Hartz Mts.*, each	2.50 to 10.00
Gold Finches, each	1.50
Gold Finch (mules), each	2.50 to 5.00
Bull Finches, not trained, each	2.50
Bull Finches, trained to sing two tunes, each	10.00 to 40.00
African Finches, per pair	2.50 to 5.00
Chaffinches, each	1.50
Talking Mino or Mina	10.00 to 25.00
Linnets, each	1.50 to 2.00
Linnets (mules), each	2.50 to 5.00
Green Linnets, each	1.50
Java Sparrows (blue), each	1.50
Java Sparrows (white), per pair	6.00 to 8.00
English Sparrows, per pair	1.00
Siskins, each	1.00
Gray Cardinal, each	4.00 to 5.00
Nightingales, each	8.00 to 25.00
Japanese Nightingales, each	5.00 to 10.00
Thrushes, each	5.00 to 7.00
Skylarks, each	5.00
Troopials, each	7.00 to 12.00
European blackbirds, each	5.00 to 7.00
Black-caps, each	4.00
Starlings, each	4.00 to 6.00

PARROTS.

Gray Parrot	10.00 to 15.00
Single Yellow-Head Parrot	8.00 to 12.00
Double Yellow-Head Parrot	10.00 to 15.00
West Indian "	4.00 to 5.00
Cockatoo (white)	18.00
Australian Shell Paraquets, per pair	6.00
"Love Birds," African Paraquets, per pair	6.00
West Indian Paraquets, per pair	3.00 to 5.00

All birds that are accomplished singers or talkers bring high and "fancy" prices. Parrots are rated by the number of words, sentences, and tunes they have learned.

AMERICAN CAGE BIRDS.

Canaries, each	2.50
Mocking Birds, females, each	1.00
" " singers	12.00 to 25.00
Robins	2.50 to 5.00
Blue Birds ("Blue Robins") each	1.50
Indigo Birds, each	1.00
Nonpariel, each	1.50 to 2.00
Virginia Cardinal, each	2.50 to 3.00
Bobolinks, each	1.50 to 2.00
Yellow Birds, each	1.50 to 2.00

Prices Paid by Dealers.

Robins, per hundred	12.00
Blue Robins (Blue-Birds), per pair	0.35
Indigo Birds, each	0.50
Bobolinks, per dozen	3.00
Yellow-Birds, per hundred	12.00
Orioles, per hundred	25.00 to 35.00
Virginia Cardinals (Red-Birds), each	0.75 to 1.00
Nonpareils, each	0.75
Blue-Jays, each	0.35
Scarlet Tanagers, each	1.00
Red-Winged Starlings, or Black-Birds, each	0.25
Woodpeckers ("High-Holers"), each	1.00
Partridges, each	1.50
Cranes, each (according to variety)	10.00 to 20.00
Wood-Ducks, per pair	2.50
Wild Bronze Turkeys (one cock, two hens)	10.00 to 15.00

FANCY POULTRY.

Guinea or Pea-Hens	12.00
Pheasants, *English*, per pair	20.00
" *Golden*, "	35.00
" *Silver*, "	30.00
Pea-Cocks, per pair	20.00 to 75.00
Bronze Wild Turkeys	15.00 to 20.00
White Turkeys	10.00 to 15.00
Bantams, trio	3.00 to 10.00
Ring-Doves, per pair	1.50
Pigeons, *common*, per pair	0.75
" *all white, common*, per pair	1.00

BIRD FANCIERS' MATERIALS.

Breeding Cages (double)	1.50 to 4.00
Trap Cages	0.75
Wire " painted	0.50 to 4.00
Wood and Wire Cages	1.50 to 4.00
Bird Lime, per box	0.25
Prepared Bird Food, per quart	0.30
Bird Gravel, per quart	0.05
Cuttle-Fish Bone, each	0.05
German Rape Seed, per quart	0.20
Canary Seed, per quart	0.20
Meal-Worms, per hundred	0.40
Nest Boxes, wire and tin	0.10 to 0.15
Nest Material, per bunch	0.10

QUADRUPEDS.

Terriers, *black and tan*, each	5.00 to 30.00
Terriers, *Scotch and Skye*, each	5.00 to 30.00
Newfoundland Pups, each	10.00 to 15.00
Pomeranian or Spitz "	5.00 to 15.00
Greyhounds, *English*, "	10.00 to 25.00
Greyounds, *Italian*, "	10.00 to 30.00
Guinea-Pigs, *common*, per pair	1.50
" " " " large	1.50 to 3.00
Guinea-Pigs, *all white*, "	2.00
Squirrels, *gray*, "	5.00
Squirrels, *all white* "	15.00 to 25.00
Squirrels, *flying* "	3.00 to 4.00
Squirrels, *small red* "	2.00
Rabbits, *common*, per pair	1.00 to 2.50
Rabbits, *fancy breed*, according to age and purity of breed, per pair	3.00 to 15.00
Ferrets, *English*, "	15.00
Raccoons, each	4.00 to 5.00
Cats, *Maltese* (males), each	5.00
" " (females), each	3.00

Cats, *Albinos, pink or blue eyes,* each	3.00 to 5.00
Rats, *white China, pink eyes,* per pair	1.50
Rats, *piebald,* per pair	1.50
Mice, *white, pink eyes,* per pair	0.50
Mice, *piebald,* per pair	0.50

Prices Paid for Pet Stock by Dealers.

Guinea-Pigs, per pair	$0.40
Squirrels, *gray,* each	0.50
Squirrels, *flying,* per pair	0.75
White mice, per pair	0.15
Monkeys, according to variety	15.00 up.

MARINE AQUARIA STOCK.

Purple Bermuda Anemone	2.00
Fringed Sea Anemone, Medium-sized specimens	1.50
White-Armed Anemone	0.50
Small Orange "	0.10
Buccinum Snails, per dozen	0.25
Silver Shrimp, each	0.10
Small Hermit Crabs, each	0.15
Small Spider Crabs (decorating)	0.15
Very Small Edible or Blue Crabs	0.20
Barnacles, each	0.15
Nest-Building Stickle-Backs, three and nine-spined, per pair	0.30
Sheepshead Lebia fish	0.25
Killie-Fish	0.10
Eels	0.10
Sea-Horses, each	3.00
Pipe-Fish, "	0.25
Serpulæ, per mass	0.75
Small Edible Mussels, per mass	0.25
Sea Cucumbers	1.00
Sertularia, per mass	0.25
Tubularia, per mass	0.25

ALGÆ (SEA-WEEDS), FOR THE MARINE AQUARIA.

Ulva, per mass	0.25
Solaria, "	0.25

FRESH WATER AQUARIA STOCK.

Stickle Backs, Nest-building, per pair	0.30

Plants, per bunch	0.15	Small Turtles, each	0.25
Shells, per quart	0.50	Snails, per dozen	0.10
Small Dip-Nets	0.50	Frogs, each	0.15
Aquaria Cement 1lb. box	0.30	Fresh-Water Mussels	0.05

Valisneria Spiralis, per bunch	0.25	For the Microscope and Fresh Water Aquarium.
Nitella-Flexilis, "	0.25	
Anacharis, "	0.15	
Ball Plant (Utricularia)	0.15	

Small Rock Sun-Fish, Rock-Fish, Sun-Fish, Dace, Cat-Fish, Tadpoles, Eels, Lizards, each	0.05

Gold-Fish, medium size	0.15	These are all varieties of the golden carp or gold-fish.
" fountain size	0.25	
" very small	0.15	
" three-tailed	0.50	
Pearl-Fish	0.25	
Silver-Fish	0.05	
Japanese King-gio	2.00	

Prices Paid by Dealers.

Aquarium fish, per hundred	1.50
Gold Fish, per hundred	5.00 to 6.00
Aquarium Plants, per hundred bunches	2.00

BEAUTIFUL AND INTERESTING AQUATIC AND SEMI-AQUATIC PLANTS FOR ORNAMENTATION OF PONDS, LAKES, AQUARIA AND FOUNTAINS.

White Water-Lily, per root	0.25
Yellow " "	0.25
Arrowhead Lily, 6 plants	0.25
Calla-Lilles	0.25
Pitcher-Plants, per root	0.25
Fresh-Water Cattails, per root	0.25
Giant Rush " "	0.25
Floating Heart (Limnantheum), per root	0.25
Calamus (sweet-flag), per root	0.25
Water-Cress, cuttings	0.25
Jack-in-the-Pulpit, 6 bulbs	0.25
Lobelia Cardinalis	0.25
Large, Showy Blue Lobelia	0.25
Water Violet (very curious)	0.25
Antipyretica Gigantia, interesting	0.25
" Fontinallis, interesting	0.25
The Water Net	0.25
Large Living Frogs	0.10

SHELLS.

Collections of small "cabinet" shells for schools, private cabinets, range from $5.00 to $50.00.

Mother-of-pearl shells, for painting, 75 cts. to $1.50.

Single specimens of cabinet shells range from 15 cts. each to $3.00.

Masses of corals, 25 cts. to $3.00.

Green snail and cowry, with the Lord's Prayer engraved on them, 50 cts. to $2.50 each.

Conch shells, for mantels or hearthstone ornaments: West India Conch, 25 cts.; East India Yellow Helmet, $1.00 to $2.50; Bahama Black Helmet, 50 cts. to $1.50; Bahama Hatchet Helmet, 50 cts. to $1.25. These shells are also for cameo engraving. Zanzibar Cameo, 25 cts. to $1.00.

Ground and polished shells: New Zealand Green Ear, 50 to 75 cts.; New Zealand White Ear, 50 to 75 cts.; Japan Black Ear, 50 cts. to $1.00; California Red Ear, 75 cts. to $1.25.

Fine shells for fancy work, according to colors and variety, per quart, $1.00 and up.

EXCHANGES.

"Crystallography" (40c.); "Electricity" (40c.); "Selection and Use of Microscope," abridged, (30c.) Either in exchange for "Workshop Companion," or two for "The Microscope," by Ross, or offers. C. H. Denniston, Pulteney, N. Y.

A printing-press, chase 5½ by 7 inches, in good order; will exchange for a large self-inking press or type. A. W. Barrett, Canajoharie, N. Y.

Home Medical Battery, cost $7; Lemair's Field-Glass, No. 2202 of Queen's Catalogue, cost $15.50; Achromatic Spy-Glass, power 25 times. To exchange for books or offers. Emerson Heilman, Heilmandale, Pa.

Silver watch, key-winder and Home Works, for good microscope or offers. Wm. Hodgson, 128 Mangin St., New York City.

A small collection of coleoptera, comprising 100 species and 300 specimens, all correctly named, in exchange for bird-skins, insects, books, or eggs. Emil Laurent, 621 Marshall St., Phila., Pa.

A small magic lantern, Ruby pattern, with twelve slides, for a good book on Entomology, with illustrations. Willie R. Hotchkiss, Morrisdale Mines, Clearfield Co., Pa.

Wanted, Thompson's "Witchery of Archery." Must be in good condition. Write before you send. J. Anthony, Jr., Coleta, Whiteside Co., Illinois.

A telescope worth $3.50, for a self-inking printing-press and outfit; chase not less than 2½ by 3½ in. Eddie Judd, 260 Connecticut St., Buffalo, N.Y.

To exchange for offers: $20 scroll-saw, Seneca Falls make, $4 Bailey circular plane, set of Auburn metallic planes, brass-bound four-foot rule, fourfold, Traut's patent combined plow, dado, etc., cost $7. F. A. Rappleye, P.O. Box 12, Farmer Village, Seneca Co., N.Y.

Bee Hive wanted; one of the old-fashioned straw "skeps"; say what you would like in exchange. Apis, care of Young Scientist, 49 Maiden Lane, N. Y.

A first-class type writer, in excellent condition, cost $125.00, to exchange for good microscope, telescope, or valuable scientific books; send full particulars. A. B., Box 114, Lewiston, Maine.

A $30 stencil outfit (Spencer's) for a self-inking printing press in good condition, chase about 6 x 9; rich ores and minerals of Idaho for scientific and instructive books, printing press, type, etc. J. P. Clough, Junction, Lemhi Co., Idaho.

Wanted pyrites of iron from Colorado gold mines in exchange for sea shells and other gems: send list of what you have to exchange. S. Ferguson, Eureka Springs, Arkansas.

A banjo in good condition, two pairs of rosewood bones, three splendid games, and a fine set of drawing instruments, for a good cornet, viola, violincello or double bass. L. B. Hill, Kalamazoo, Mich.

The Young Scientist

SCIENCE IS KNOWLEDGE. KNOWLEDGE IS POWER.

INDUSTRIAL PUBLICATI

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Casting in Plaster of Paris.—IV.

BY MARK MALLETT.

PIECE-MOULDS are made of plaster, but in sections so arranged that each piece can be pulled, without obstruction, from the cast. That they may thus 'leave' freely often necessitates that these sections should be very small and numerous. In making a piece-mould for a face, for instance, a dozen pieces or more will often have to be made.

A piece-mould cannot be taken direct from the clay model. A cast must first be made by means of a waste mould. This cast must, as a first step, be rubbed over with a little lard, which, on account of its whiteness, is better than oil or any other kind of grease, as it will not discolor the work. This is to keep cast and mould from sticking together. A little plaster must then be mixed, and the first section of the mould built up with the spatula on the cast. It will have to be made some three-quarters of an inch or more, according to circumstances.

When this piece has set, it can be pulled from the cast, its sides trimmed round with a knife, and lard must be rubbed over them. It must then be replaced, and two more pieces can be cast on two of its opposite sides, the outer edges of which will, in their turn, require paring and greasing, and the work can thus be carried on until the whole cast has been mapped out and covered with pieces larger or smaller, as the necessity for making them "leave" the surface freely may demand.

Lastly, an outer mould or shell, in two or more large pieces, to envelop and bind all the small pieces together, has to be made. Before the mould is filled these have, in their turn, to be bound and tied together with string. When this has been done—so closely will all the different pieces which have been cast one upon another, necessarily fit together—the

mould will seem as perfect and compact as if made of a single piece.

When such a mould is filled, a much thinner cast may be made then with a waste mould. A defect belonging to the piece-mould is that a little seam will show upon the cast wherever two pieces meet, and require cleaning away. A mould of this kind may be left for any length of time and filled repeatedly; but the seams will grow wider and more unsightly with use.

Piece-moulding is a delicate and tedious operation, and one that demands both skill and patience; its practice can scarcely be recommended to the amateur until he has had some practice in the working of plaster by the simpler methods.

Moulding from Marble.—For reproducing marble statuary in plaster, piece-moulding is usually employed, nor is there any material from which a piece-mould can be more readily taken. Instead of lard or oil, however, white curd soap only must be used on marble.

Casting from Nature.—Among the applications of the art of casting, none is more generally interesting than this. It is within the reach of the most indolent amateur, and will well repay him for bestowing a few odd hours upon it. To model a piece of good ornament, or still more, faithfully to portray the form or features of a friend, demands study and aptitude; but by means of casting, results somewhat similar may be borrowed direct from nature by any one. Let us begin with the human figure.

Though of course inferior in those qualities to the face, the human hand is full of character and expression. It is easy to recognize the hand of one with whom we are familiar. A cast of the hand is a pleasant memento, and few things can be easier than to make such a cast.

The sleeve of the person to be operated on should be rolled or twisted at the point where the cast is intended to be terminated. A little oil should be rubbed over the skin. As a cast showing one side of the hand will generally be all that is required, the mould can be made in a single piece. A soft pillow should be provided, a towel spread over it, and on that an old newspaper. With a little arrangement the pillow can be so made to accommodate itself to the form of the hand, and will so rise it as to leave no openings beneath; for if openings are left, the plaster will run into them, and there will then be a difficulty in getting the mould away. The mould can then be made in the usual manner. The hand must, of course, be kept *perfectly still* till the plaster has set, or the work will be spoiled; after it has set, it will be still of necessity till the mould has been removed. When the mould is finished the hand can be lifted from the pillow; the paper will prevent the plaster from sticking to the towel. Any little tongues of plaster which may have forced their way under the fingers can be cut away with the scraper, and the hand will be released without difficulty. When all is finished, and the mould clipped away, the operator can scarcely fail to be pleased with the results of his labors. Every fold of skin, and line, and marking, will be seen reproduced with the most microscopic fidelity.

Both sides may be moulded, if desired, and the hand reproduced in the round instead of in relief, by making a second half to the mould, according to the methods already described.

Not so easy is it to mould the face, or "mask," as a cast of the face is called, though this, when taken, is a thing of far higher value, for in no other way is so faithful a copy of the features obtained. The person whose face is to be operated upon should lie on his back, or sit with his head thrown backwards on a cushion. Towels should be placed over the hair and round the throat, to prevent the plaster running where it is not wanted. Whatever hair will necessarily come in contact with the plaster, as round the forehead, the eyebrows, moustache, beard, and whiskers, must be well plastered down with soap. Casting a mail mask is a matter of far greater difficulty in these days than it was in those of our fathers and grandfathers, when men went clean shaven. The hair and eyebrows are easily disposed of, but the beard and moustache are less tractable; and the novice is

rather advised to try his skill in the first place on a boy or a woman. A little soap or oil should be rubbed over the skin, and as the mouth will have to be kept close shut throughout the operation, quills or straws must be provided for insertion in

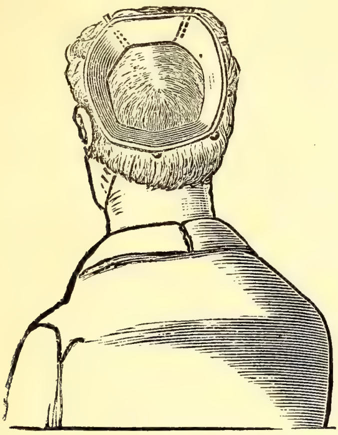


Fig. 4.—POT-LID IN MOULD FOR BUST.

the nostrils, that respiration may not be stopped. The plaster should be mixed with warm water. The sensation when liquid plaster is poured over the face is by no means an agreeable one, and this precaution will tend to the comfort of the patient; besides, as it will lessen the shock it will lessen the danger of any involuntary movement of the muscles of the face, and that these should remain rigid till the plaster has set, is essential to success.

During the ten minutes or so which must elapse before the mould is hard enough to be removed, the time will pass tediously for the person operated upon, and though there will be no real difficulty in taking it off, if the instructions given be carefully followed, some little pain may be occasioned; for any stray hairs which have become imbedded in the plaster will probably be pulled out, and will come off with it.

In a cast thus taken, the eyes will of course be closed, and the expression will be one of sleep. This is sometimes altered afterwards, if the person who takes the cast has some little skill in modelling, the eyes can be carved and made to appear open; and the remainder of the head and bust can be modelled to the mask from nature. But a work so treated is rarely satisfactory. It is really better and more valuable as a memento when kept as taken, and looks well if mounted on a slab of wood, covered with dark velvet.

Taking a mask in this manner after death, though a melancholy, is a much easier task. Under such circumstances no danger of failure is to be dreaded. That impatience on the one hand, and hurry on the other, which act as disturbing influences in casting from life, have not now to be taken into account. A mask taken after death forms a sad but precious memorial, and is an invaluable help to the modeller if a posthumous bust should ever be required.

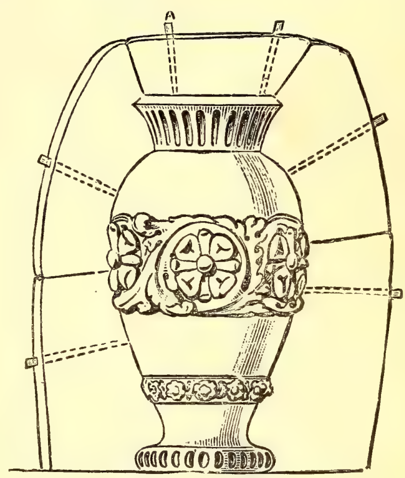


Fig. 5.

Such small animals as are cased in fur or feathers are difficult subjects for the caster, but fishes and reptiles are well adapted for his purposes. These lower organizations can, with little trouble, be arranged in life-like positions and moulded, a little oil being first brushed over them. Sand can either be packed beneath them, so as to allow the mould to be taken in one piece, or they can be half buried in that material, and their upper halves first moulded. They can then be

carefully lifted up, the sand cleaned away, the edge of the mould keyed and clay-watered, and the second half of the mould cast. By this means casts in the round will be obtained, and the plan is admirable for reproducing fishes or snakes, though not so easily applied to reptiles with feet, such as lizards.

Casts from animal life are often of scientific value for preserving the forms of remarkable specimens. They are frequently most useful, for reference, to the designer and carver in wood, stone, etc., or they may be made of service to those who work in metal or electrotype. A prettier, if not a more interesting department in the art of casting, is that which deals with vegetable forms, and chiefly with foliage. Leaves are admirable subjects, and easily dealt with.

If we take a single leaf and lay it on a table or flat board with a view to moulding, we shall at once see that it does not lie flat. It will touch only in two or three places. It is not the custom of nature to model her leaves in a single plane; she has so designed them that from whatever point of view we may regard them, they

Fig. 6.—QUARRY OF A DIAPER.

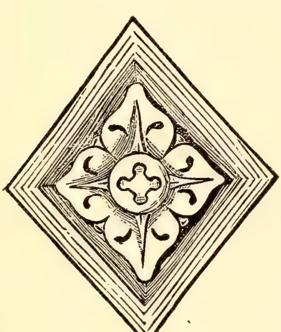


Fig. 7.—SECTION OF QUARRY FROM A TO B.

will present variety and beauty of curve. If therefore we desire to reproduce the leaf as nature has formed it, we must not flatten it, or allow it to be flattened by the weight of the plaster. We must find means of supporting it in its natural attitude. There are different methods of so fixing leaves, but none is simpler than to take sand, as advised in casting small animals. Spread a level surface of this on your table or board, and lay the leaf upon it. With the spatula it is easy so to pack sand beneath the leaf as to support it in every part. Leaves do not require preparing for moulding by either damping or oiling.

When the mould has set, it may be lifted from the sand, and the leaf will then be seen sticking to its under surface. Probably the plaster will in places have run in a little, and overlapped it. If so, such superfluous plaster may be carefully cut away with a pen-knife, after which the leaf can be peeled from the mould without difficulty; and the sand which adheres to the outer surface of the mould can also be brushed away.

As the mould is chipped off, the operator will indeed be hard to please if he is not both delighted and astonished with the effect of his work. He will see every serration, every vein and marking traced out with the most perfect delicacy in the pure white plaster, and will be struck with beauties of form and arrangement, which, when accompanied by their natural color, had wholly escaped his notice. By exercising a little judicious packing, fruits and berries can also be cast.

For the wood and stone carver, and indeed for all who practice the arts of decorative design, the importance of possessing casts from foliage cannot be overrated: in no other way can the designer so well have nature at hand for permanent reference. Such casts may also be applied direct to the purposes of decoration. For indoor uses, where plaster can be safely employed, casts from leaves and fruits, tastefully arranged, may be used for capitals, cornices, diapers, etc. In Fig. 8 a rough attempt has been made to show how such familiar leaves as those of the strawberry and gooseberry might in this manner be utilized in diaper as a wall decoration.

In this diagram only a simple arrangement of detached leaves has been shown, each enclosed in a sunk panel which may

be struck with the compasses, and cut out in plaster in a few minutes. But it is possible so to combine different leaves and fruits as to form most elaborate designs. In this latter case it will generally be better to cast each leaf, etc., separately, and afterwards to fit them in their places. If, however, the design when thus put together has to be repeated again and again in course of the decoration, a gelatine mould should of course be taken of the "repeat," copies of which will thus be quickly multiplied. In Fig. 8 two gelatine moulds are supposed to be employed.

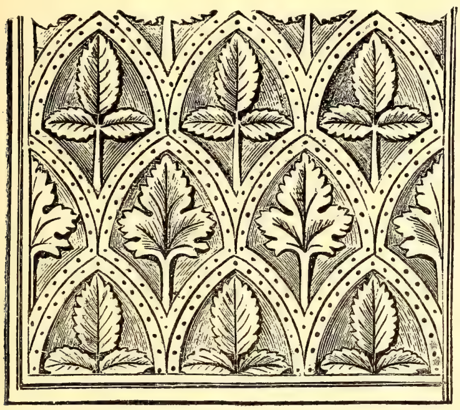


Fig. 8.—LEAVES IN DIAPER WORK AS WALL DECORATION.

It will thus be seen that casting from nature may by itself, and for its own sake, be considered an interesting art, and one worthy the attention of the amateur. The directions given for carrying out work of this kind for decorative purposes will, it is hoped, be of service to many to whom the utilization of natural objects in this manner has not hitherto suggested itself.

A Chat About Mitres.

In almost every piece of furniture that a cabinet-maker has to manufacture, one of the most important things to be done, after having framed the job together and got the " skeleton " finished, is to mitre in the mouldings, etc. To one unaccustomed to examining the detailed construction and manufacture of cabinet-work, the amount of mitering on any ordinary article of furniture such as a wardrobe would be truly astonishing. There are the mouldings to be mitered in the door frames, the mouldings, maybe, on the drawer fronts, the facings and mouldings on the cornice and plinth, and should the front of the job be broken by pilasters fixed on the doors, the mouldings of the cornice and plinth will have to be mitered round these also. Consequently there are a great many contrivances (some of which are purely local), known to most cabinet-makers, which are calculated to assist the workman, and remove some of the difficulties which mitering entails. Most of these, such as the mitre "cutting block," mitre "shooting board," etc., can be bought at any tool shop; but the one generally called the "mitre trap" cannot be bought at any tool manufacturers, and though well-known to the majority of workmen in the form of the finished article, the method of making such a tool is not so universally known. To many amateurs, therefore, a short description of how to make such a tool will, we trust, prove of service.

One form of mitre trap is shown in Fig. 1. It consists of three blocks, the

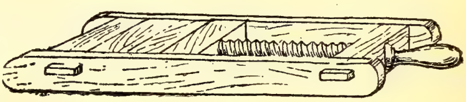


Fig. 1.

faces of two of them being cut at an angle of forty-five degrees, which work in a frame by means of a screw.

To make this tool, first get out the wood for the frame, which is separately shown by Fig. 2. The inside size will be about 18 inches by 8 inches. This frame will for appearance sake be mortised and tenoned together, although of course it would do quite as well if dovetailed. The two ends must be cut about 15 inches by 3

inches, and 1½ inch thick, and the two longer pieces 24 inches by 3 inches, and 1½ incn thick. As will be seen from Fig. 2, which is a front and end elevation of the frame, the tenons are left projecting over the front pieces about 2 inches, but only on one side. The use of this will be seen later on.

End View.

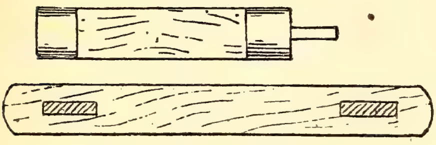


Fig. 2.—Front View

When this has been framed together "dry," that is, merely knocked together without being glued, and the projecting ends of the frame nicely rounded off, it must be laid on one side while the blocks are being prepared. The number of these latter is in a measure dependent on the will of the workman, as only two blocks are absolutely required, the mitre being cut by the wood being placed between. But as by the addition of one block the mitre trap may be used for "shooting" the ends of drawer fronts and such like, it will be much better to have three blocks. Cut these out, therefore, each 8 inches long by 3 inches square. After fitting these to the required length, so that they will work easily up and down in the frame, two of them are required for the mitre, a section of which is shown by Fig. 3. The other block must be left square. Now, take the frame to pieces, and work a couple of grooves along the inside of the two long sides, and across the end of the three blocks. Cut out and fit two tongues of hard wood into each of the grooves in the end of the blocks, which will now be of the appearance shown in Fig. 4.

The frame must now be glued together, the blocks being put in the order shown by Fig. 6, the grooves in the frame, and the tongues in the blocks allowing the blocks to move backwards and forwards in the frame. A screw must next be procured out of a piece of boxwood, and must measure about 16 inches in length, including the handle, and about 1 inch in diameter on the thread. In order to attach the end of the screw to the block, a plate of brass about 2 inches by 1 inch, must be fixed on to the end of the screw at A (Fig. 5), in such a manner that it will, when screwed on to the block marked B on Fig. 6, work the block backwards or forwards by simply turning the handle. The tool will now be of the shape shown in Fig. 6, which is a section cut right through the centre. To make a mitre, the wood must be placed between the blocks C and D, and then planed down to the level of the frame. To shoot a piece of wood square it must be placed between the blocks D and C. The best wood of which to make this tool is mahogany, though any hard wood will do. To fix it on the bench, place a holdfast on one of the projecting tenons, and screw firmly down.—*Builder and Wood-Worker.*

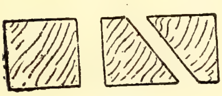


Fig. 3.

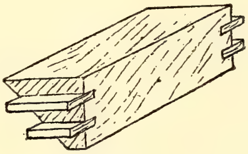


Fig. 4.

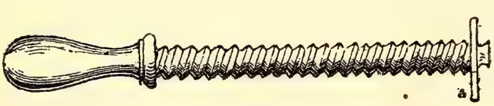


Fig. 5

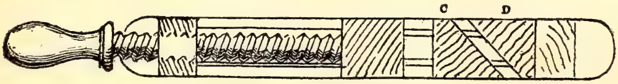


Fig. 6.

—When desperate ills demand a speedy cure, distrust is cowardice and prudence folly.

Something About Saws.—V.

BY "OUR NED."

SOMETIMES the amateur may have occasion to use and care for saws that are not intended for cutting wood; and when such is the case, he will find it to his advantage to possess some knowledge of the manner in which such saws are filed and used, and such other useful information about them that may be requisite. Doubtless every boy who reads the YOUNG SCIENTIST has noticed a tool hung up in his father's kitchen shaped something like the illustration shown at Fig. 1; and although he may have seen it often, unless he saw it used by the cook, he would probably never suspect its real mission. This is a butcher's saw, and its chief use is to sever bones, but unfortunately for the saw, when it gets into the kitchen it is made to do service for a half-dozen tools. It is frequently used by the "hired help" for cutting kindling-wood, and it often finds itself struggling "tooth and nail" with some tack or tenpenny nail that refuses to move from the path it is forced to follow, and there are instances where it has been known to do service as a hatchet.

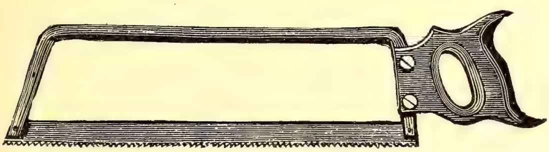


Fig. 1.

The form of teeth for this kind of a saw are shown at Fig. 2; they are equilateral,

Fig. 2.

which gives the pitch of the teeth an angle of forty-five degrees, front and back. To work nicely these saws should be well and truly jointed, filed square on front and back, and should have from twelve to eighteen teeth to the inch. Very little set is required in these saws.

The surgeon's saw—which may also be said to partake somewhat of a butcher's saw—is treated a little differently from the legitimate butcher's saw, though both of them are intended for cutting bones. This is owing to the fact that the human bone in a live person is not nearly so hard and brittle as the bones usually operated on by the ordinary butcher's saw. Being softer and somewhat porous, the living human bone requires a saw with a little more pitch, and a more acute bevel than is necessary for a butcher's saw, and it should be filed and jointed with the greatest care, every tooth being on a line, and jointed so that every tooth will be in a line on their side-cutting edges.

Fig. 3 shows the form of teeth adapted for these saws. It will be noticed that the form of teeth shown is something similar to teeth prepared for cutting hard wood. The number of teeth to the inch required for these may be from fourteen to twenty, according to the work required to be done.

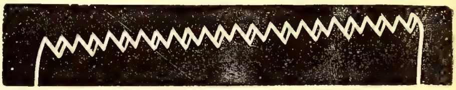


Fig. 3.

The next saw under notice will be the "hack-saw," or the blacksmith's saw, as it is sometimes called. This is used for cutting iron or brass. The blade should be hard, and the line of teeth perfectly straight.

Fig. 4 shows one of the better sort of

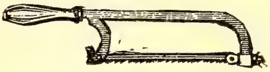


Fig. 4.

these saws. Like the butcher's saw and buck-saw, it comes in for a good deal of hard usage, but its character and vitality is such as to render it invincible, and though in many cases it would work better if cared for properly, it manages to perform its duties with a fair degree of satisfaction.

Fig. 5 shows the form of teeth suitable for these saws; they should be fine and filed square across, and the backs of the teeth should be filed square also. The teeth must be jointed all to one length and filed up to sharp points, and must stand square out on the edge of the blade.

Fig. 5.

It is better not to joint saws of this sort on the sides, as the edges left on the teeth by the file help the saw to cut the metal.

I have seen a piece of an old scythe do good service as a hack-saw, when the latter was not at hand. The edge of the scythe was nicked with a cold chisel, and then touched up with an old file, and the results obtained from using the impromptu saw were quite satisfactory. A hack-saw is simply a very thin file, with the cutting teeth all on one edge.

Brass, silver, zinc or gold may be easily cut with a hack-saw having fine teeth and a narrow blade, for inlay work or for metal ornaments. If the saw is adapted, it may be used in a foot-power scroll-saw, and, with patience, may be made to perform excellent work.

For cutting ivory, pearl, bone or shell, the teeth shown in Fig. 2 are the most suitable, but they require to be very fine and in good order.

Hack-saws, or metal-cutting saws for scroll or inlay work may be made from watch springs, and if the teeth are properly formed and made even and regular, they may be made to do good work. I have often made saws for cutting scroll-work in hard wood of watch springs, when I could not get the kind of saws I wanted without going to considerable trouble. When well made they will outlast anything that you can purchase, but they are very difficult to put in order when once they require it.

I think, from what I have said in the papers on the subject of saws, that the amateur who has followed me closely will be able to keep his saws in tolerable good order, and repair those belonging to neighbors who have not been so fortunate as to get the YOUNG SCIENTIST regularly. In a future paper I will endeavor to illustrate and describe some of the aids and appliances connected with amateur saws and their uses.

Amateur Boat-Building.—II.

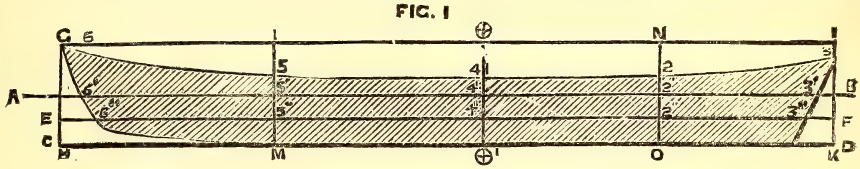
IN making a set of designs for a boat or a ship, the object proposed is analogous to that entertained in the preparation of drawings for a house or a steam-engine. This object is the representation on a plane surface of the thing to be constructed as viewed from at least three positions—or in elevation, in plan, and in section or sections. In the construction of vessels also, as in regard to the house or the engine, the preparatory drawings, must be made *to scale*, that is to say, that in all the set of designs a certain definite and unchanging proportion to the dimensions of the thing to be made shall be observed, as, for instance, one-eighth of an inch in the drawing shall stand for one inch in the boat or machine, or one inch in the former shall be equivalent to one foot in the latter, and so on. The larger, as a general rule, the scale upon which any working drawing is made, the better. In a shipbuilder's yard the lines of a projected vessel are frequently laid down on the floor of what is termed the "mould-loft," one-quarter, one-half, or even the full size of the vessel to be built.

For the purposes of our amateur boat-builder, however, a less ambitious scale will suffice, as very large drawings for his presumably small craft may be inconvenient. Speaking generally, a scale of one-eighth will be large enough. This has the further recommendation that, as the workman must provide himself with a rule on which the inches are divided into eighths and sixteenths, he can readily abstract his measurements therefrom. It is not advisable to adopt a less scale than one-eighth, however, and if the boat is not a long one it will be better to design it upon a scale of one-fourth the actual size of the proposed craft.

In the illustrations, Fig. 1 is the "sheer

plan," Fig. 2 the "cross-sections," and Fig. 3 the "water-lines" of the boat. The line A B in Fig. 1 represents the "load water-line," and indicates the depth of the boat's immersion when laden. The line C D, parallel with this load water-line, shows the draught of the boat, and a horizontal line, E F, is drawn equidistant from these two lines. The vertical line ⊕ ⊕′ corresponds with the broadest part of the projected boat, at what is called the midship frame. In nearly all drawings of marine architecture the symbol ⊕ (the same as that used in astronomical almanacs to designate the earth) is usually employed to denote this portion of a vessel. The midship frame is generally placed abaft (or behind) the exact centre of the boat, so that the part of the hull before it is longer than that portion behind it. The perpendiculars G H (at the bow) and I K (at the stern) are then drawn, and other perpendiculars, L M and N O, midway between the bow and the midship frame and that part of the boat and the stern.

FIG. 1



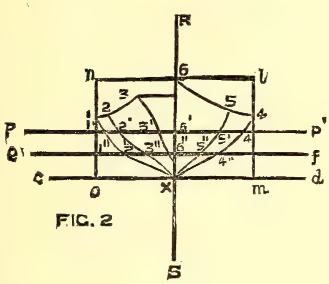


FIG. 2

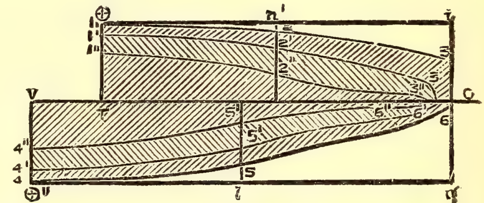


FIG. 3

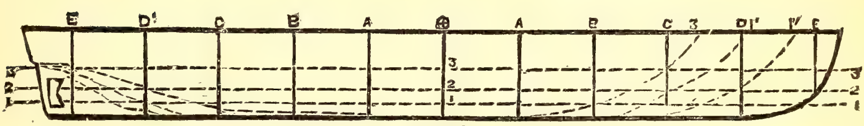


FIG. 4.

FIG. 5

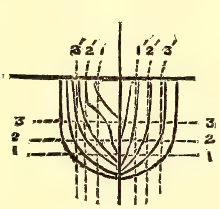


FIG. 7.

FIG. 6

Fig. 2 (showing the cross sections) and Fig. 3 are drawn on the horizontal lines P P′′ and Q Q′′ respectively. For Fig. 2 the horizontal line P P′ is bisected by the perpendicular R S, on each side of which the semi-breadth of the boat is set off at *n*, *o*, *l*, *m*. Here the line P P′ indicates the water-line shown by A B in the sheer plan; *c d* corresponds with the line of the greatest draught of the boat as at C D in Fig. 1,

and *e f* similarly occupies the place of E F in the same figure. The depth from *n* or *l* to the line P P′′ is that of the extreme height of the bow from the load water-line A B (Fig. 1).

For Fig. 3 the semi-breadth of beam is set off on each side of the line P′ Q, as at T ⊕, Q *i*, and V ⊕′′; Q *g* the distance, ⊕′ *i* being made equal to ⊕ I (Fig. 1), or the after part of the hull, and the distance ⊕′′ *g* being equivalent to that of ⊕ G (Fig. 1), or the fore part of the boat. The two lines *n*′ and *l*′, holding corresponding positions to N L (Fig. 1), are also drawn.

The designer is now able to fill in the cross-section lines and the water-lines of the craft. We may mention that the small figures as 1, 1′, and 1′′ indicate similar points in the three figures.

The shape of the boat itself (shown in Fig. 1 by the diagonal shading) is in the main dependent on the taste of the designer; but much care and discretion should be exercised on its careful proportionment and outline. That part above the load water-line is termed the free-board, and may differ considerably, according to the destination of the boat. It may be well to state that there is no necessity for shading the outline of the boat as in Fig. 1. It is only done in this instance to render our instructions more clear.

The lines 1′ 2′ 3′ and 4′ 5′ 6′ are now to be drawn on Fig. 3. These lines represent the load water-line A B (Fig. 1) for both ends of the boat.

The lines 1 1′ 1′′ X and 4 4′ 4′′ X in Fig. 2 are next put in, representing the midship section, and therefore necessarily having the same degree of curvature. This curvature depends upon the taste of the builder, except in so far as it is governed at the load water-line by the distances of the lines 1′ and 4′ on Fig. 3 from the line V Q.

In the cross-sections (Fig. 2) the lines 2 2′ 2′′ X and 5 5′ 5′′ X are next put in. These are shown on Fig. 3, at *n*′ and *l*′, and must be set off from the perpendicular R S (Fig. 2) on the line P P′ and equivalent distances at 2′ and 5′ to the same distance as 2′ and 5′ from the horizontal line V Q at Fig. 3, the remainder of the curve being a matter for the designer's taste and discretion. The line 3 3′ 3′′ for the stern is next drawn, and the cross-sections completed. It will be seen that the section to the left of the line R S is the after-part of the boat, and the portion to the right of that line is the forward half of the boat from amidships.

Fig. 3 may now be completed by the insertion of the remaining water-lines. We already have 1′ 2′ 3′ and 4′ 5′ 6′ for the load water-line. It is now necessary to put in 1′′ 2′′ 3′′ and 4′′ 5′′ 6′′, corresponding to the line E F on the sheer plan (Fig. 1), and the lines 1 2 3 and 4 5 6, corresponding to the line of the gunwale, as denoted by the same figures in the sheer plan.

It is thus clear that we have at Fig. 2 a series of vertical sections of our boat, and at Fig. 3 three horizontal sections of the same. If we imagine the boat cut into three flat slices by sawing it through at the two lines A B and E F (Fig. 1), we have the outlines of the planes given at Fig. 3. In order to render our meaning more plain, we have shown the plane of E F (Fig. 1) on Fig. 3 as filled in by shading diagonal lines sloping from right to left. In a similar manner the superfices at the load water-line A B (Fig. 1) is shown by lines slanting from right to left, while the length and breadth of the boat at the gunwale are denoted by vertical shading. It must be understood, however, that no such shading is needed in the regular working drawings.

Vessels of all kinds are designed in a very similar manner. Sometimes the section is termed the "body plan," and the plan of the water-lines the "half-breadth plan." Thus Fig. 4 shows the sheer plan of one of our large steamers, Figs. 5 and 6 the half-breadth plan of the same vessel, and Fig. 7 the sections or body plan. An inspection of these construction drawings may serve to render the foregoing remarks more easily understood. It will be seen that the straight load and other lines shown at 1, 2, 3 in the sheer plan become curves in Figs. 5 and 6, while, contrariwise, the lines 1′, 2′, 3′, which represent vertical planes, from the

deck of the vessel downwards, parallel with the keel, become curves in Fig. 4. In Fig. 7 both sets of lines appear as straight lines at right angles to each other. Of course in the actual construction drawings of a large vessel many more lines than are here shown are inserted; but we think sufficient has been said to show the principle involved, and to make it plain that the workman has in these three plans the exact position of each point of a vessel's exterior clearly indicated.

(To be Continued.)

Fried Ink-Pots.

BY A. W. ROBERTS.

FRIED ink-pots? Yes, "fried ink-pots;" fried in lard or olive oil, and mighty nice they are, too! Just as tender and sweet as fried scallops, which in flavor and texture they resemble very closely. Many and many is the ink-pot I've captured at night-time, and the darker the night the better luck one has, for it stands to reason that the glare from a jack-lamp or bull's-eye dark-lantern will have a stronger fascination over these uncanny-looking creatures on a pitch-dark night than on a moonlight or starlight night. Poor devils! (they belong to the devil fishes) they can't resist the temptation, the fascination of a glare of condensed light. They will swim right up to it, and into it, staring at it all the while with their unearthly, baneful-looking eyes. Then's the time to snake 'em in! All one has to do is to softly and slowly slide a long-handled and shallow scap-net under them; then quickly lift them into the boat and as quickly dispatch them with a few thrusts of a pen-knife, for if this precaution is not taken they will pump out and eject a black fluid from their funnels, which is called the ink. From this habit of ejecting an inky fluid they have been christened by the fishermen of Long Island "Ink-Pots." The fishermen of the Massachusetts coast have named them squid; naturalists, the *Loligo pallida.* I have concluded that for a common, popular, and well-fitting name, in pure and simple English, ink-pot is good. If some of the inky fluid is pricked into the skin, the same as in India-ink, it will produce a blue-colored tattoo, like India-ink, and it is said, on good authority, that the India-ink of the Chinese and Japanese is made from a similar substance, that is obtained from a variety of this fish, which is an inhabitant of the waters of

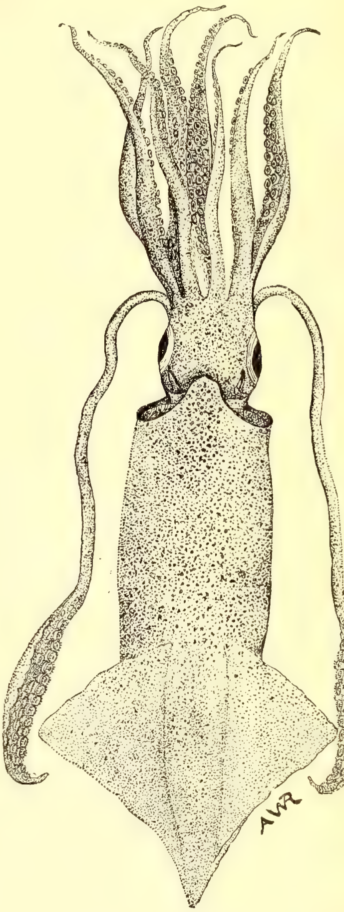


Fig. 1.

China and Japan. The same is the case with the coloring substance known as sepia, which is derived from the *Sepia apicinalis,* also a related variety of the *Loligo pallida.* The original sketch from which the engraving of the ink-pot (Fig. 1) was produced was drawn entirely with the ink that was taken from several of these strange inhabitants of the ocean.

After it was strained and evaporated, or, more strictly speaking, condensed, it was mixed with a small quantity of the spirits of ammonia and distilled water, after which it was thoroughly ground on a slab with a glass muller. When Nature provided this strange, grotesquely-shaped creature with a goodly supply of ink, it would seem as though she was mindful of the fact that he was not an expert swimmer, and as for turning short curves and corners that was an impossibility, but to give him a show to escape from his enemies, she provided him with this ink-supply, and right well he knows how to use it, for the instant his pursuers are closing on him, he lets go the ink which is stored up in his funnel with such force that in an instant it spreads out before in the form of an intense black cloud, so that while his pursuers are wondering what has burst, he beats a hasty retreat backwards through the ink-cloud, and down to the dark and deep waters of Mother Ocean. I strongly suspect that this inky fluid is very repugnant to fish, as they show a strong inclination to avoid it under all circumstances; perhaps it has a somewhat similar effect on fish that the thick and milky liquid which a toad will eject when attacked by a dog or cat, causing them to feel sick and of a retiring turn of mind. All the large kinds of free swimming and edible fish are passionately fond of the ink-pots, and why should they not be, for is he not a soft, sweet, and toothsome morsel? This being the case, he is in great demand as a bait for our game marine fishes, such as striped bass, sea bass, weak-fish, etc. By the mackerel fishers he is considered the very best of bait, when cut up into a fine hash. This hash is thrown broadcast over the water, till the mackerel are "chummed" together, after which an immensely long net is run around them, and they are prisoners. The squid, by which name it is known in our markets, always brings a high price, as a favorite fish-bait. Don't make the mistake of thinking that fish are the only creatures that like and eat this odd-looking, and to very many, repulsive-looking creature, for such is not the case, as the Chinese, Japanese, Portuguese, Spaniards, and French are all excessively fond of Mr. Ink-Pot, and pay high prices for him. The Portuguese and Spanish cooks are very particular when purchasing this fish that he contain a fair quantity of the ink, from which, when combined with wine, a dressing or sauce is made, that is anything but inviting-looking, as far as color goes, but to the taste is really enjoyable. I have known the squid to bring as high as from 75 cents to $1.00 per pound retail, and hard to obtain at those prices. I stated that this fish was destitute of any bony structure; perhaps that was hardly correct, for it is provided with a curiously-shaped bone, which in form strongly resembles a quill-pen, from which fact it has been called the "pen" (Fig. 2). This pen is transparent and flexible; the material closely resembles that of a goose-quill. The well-known "cuttle-fish bone" used by bird fanciers is also a product of a fish closely related to this fish. During the spring months immense quantities of the eggs of the ink-pot are cast upon the southern shores of Long Island. These are so puzzling to the ordinary investigator that after many attempts to determine their nature, he concludes that they are one of the strange, unfathomable mysteries of the ocean. These egg masses, when first exhuded, are not more than one-third of the size and weight of the squid; but after being in the water a few hours they swell to more than ten times the size of the parent. When a youngster it was a great mystery to me how frogs and ink-pots managed to deposit masses of eggs which were, in size, often ten times larger than themselves. To convey a clear idea of the egg clusters of the ink-pot I have made a pen sketch, Fig. 3. These eggs are very easy to develop if one has even a very small aquaria or a tub full of good salt water. To do

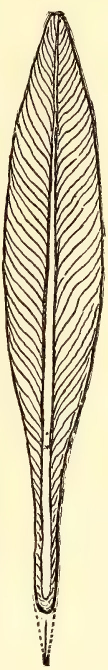


Fig. 2.

this eggs should be selected that contain well-developed or advanced (often living) minute ink-pots; this can be easily done by means of a powerful pocket-lens. The young ink-pots, when placed under a microscope, are wonderfully beautiful objects, showing both the blood circulation and the circulation and constantly changing of colors through the pigment cells.

Fig. 3.

The squid moves by taking water into the hollow funnel or body and ejecting it again with great force. This moves the squid backwards through the water with great speed and in short, jerking reaches. One of the curious features of this fish is the great number of sucking disks that are distributed in rows on the short and long arms. Each disk consists of a short and thick cylinder, the center of which can be raised so as to establish a vacuum between itself and the part to which it adheres. The sucking power of a medium-sized squid for its size is very great. The food of the squid consists of fish and small crustaceans. They have often been observed at Cape Cod capturing the fry of the mackerel, their method of taking so nervous, shy, and rapid-moving a fish being very interesting. Immense numbers of the squid would approach the shallow water at low tide, and laying flat on the bottom, their bodies assuming the color of the sand on which they were resting, they would wait patiently till a school of young mackerel passed over them, when instantly the long claspers or feeding arms would be shot upwards and a young mackerel would be seen to disappear. After the long arms had conveyed the fish beneath the water, the shorter arms, with their hundreds of sucking disks, would entangle the fish in their grasp and convey it to the mouth of the squid, which, being provided with two powerful jaws resembling a parrot's beak, was soon devoured, bones and all.

Overglaze Painting on Porcelain.—II.

BY AURELIO DE VEGA.

SOFT PORCELAIN.—It will be more convenient to notice next the soft porcelain. This is a French make. The principal portion of the body is practically a glass. The vitrifying materials (sand or flint, gypsum, and saline and alkaline ingredients) are fritted, that is, melted, cooled, and pulverized, and then mixed with the infusible body which is a white marl. The proportions being three parts of the former to one of the latter, the softness of the ware is at once recognized. It is principally used for statuettes, vases, and such like articles.

The most perfect examples of this kind of ware are found in the old Sevres ware, which is now imitated pretty successfully in many establishments at home and abroad.

(c.) *English Porcelain.*—The English porcelain differs from the hard in the introduction into the body of a large proportion of calcined bones, the effect of which is to render it better able to resist great heat and sudden changes of temperatures, and to give it a place as regards hardness between the other two kinds. Three descriptions are made—one for ordinary table use, one more delicate for dessert and the better tea-services, and the third, somewhat softer, for *objets d'art.*

The innovation which gave character to this ware was the work of Josiah Spode, who succeeded his father in 1797, and since it was generally accepted by the English makers, similar ware has been regularly made in our factories.

(7.) *Glazes,—(a) Hard.*—As with the wares so with the glazes, there is great variety. The hard porcelain admits of no metallic constituent in its glaze, which is composed solely of ground felspar or "crockery stone," with sometimes an addition of gypsum. These materials require for their perfect vitrification a very high heat, or, as it is called, a *hard fire,* and the glaze is therefore exceedingly hard.

(b.) *Soft.* The glaze for the soft ware is a specially prepared glass of the crystal kind, containing about two-fifth parts of lead oxide. Incipient fusion takes place, therefore, at a comparatively very low temperature.

(c.) *English.*—The English glaze, like the English ware, occupies a middle place. It is so far like the hard that it

contains a large proportion of felspar, but like the soft it contains lead. In this case, however, the metallic element is only about one-fifth of the whole. From the artist's point of view the approximation must be regarded as inclining towards the soft rather than towards the hard.

8. *General Test for Hardness.*—To complete the differences which we have now noticed in our goods, it is only necessary to add that the soft ware is, as a rule, of a slightly dingy and yellowish tint, and is more transparent than the other kinds, and that the glaze may easily be scratched with the point of a penknife. A very practical test is that boiling water heat when suddenly applied is generally sufficient to crack it, but this I fancy will be seldom tried.

9. *Effect of the Glaze upon the Painting.* We are now in a position to form an opinion as to the extent of the influence which any particular glaze will have upon the appearance of the work done upon it. It follows, from what has been said, that the harder the ware and its glaze, the more superficial is the latter; while the softer the ware and the more like it its glaze, the more complete and intimate is the incorporation of the two.

What to Undertake.—If, however, the work be, strictly speaking, only *attached* to the ware, in that of the soft the flux is practically *a continuation of the glaze.* The mode in which these conditions operate upon the painting is immediately obvious when it is stated that the pigments are of a vitreous nature or are mixed with a vitreous vehicle. The harder the glaze, the more superficial and less glossy is the painting; the softer and thicker the glaze, the more deeply does the color sink into it. I have an old Augustan (Dresden) cup and saucer, one of the colors employed in the decoration of which has absolutely no union with the underlying glaze, and is secured only by its connection with the color surrounding it. It has properly vitrified, but has not become incorporated with the hard glaze which appears in some spots where the color has chipped off. Compare such a work as this with a painting executed upon a piece of old Sevres, and how striking is the difference in the appearance of the two. In the former the colors are in large part hard in appearance and dryish, and generally lack that full and perfect gloss to be found on the latter, which presents a velvety softness of look. The reason is clear. The degree of heat adapted to reduce the pigments to a proper state of fusion is insufficient to affect the hard glaze to a corresponding extent, and the paint remains on the surface and looks more or less *dry.* If the glaze is sufficiently hard some colors may altogether fail to adhere, and the work of the painter, who by mistake has selected a piece with such a glaze, be entirely thrown away. The softer glaze, on the other hand, yields to the heat sufficient to vitrify the pigments, and so these sink more or less deeply into the body of the glaze, thereby acquiring that peculiar depth and richness of tone, which have given such charm and value to the old English and French wares. This very peculiarity, however, limits its range of usefulness, as it is only suitable for certain kinds of decoration in which rich and very showy colors are required to be used pure. The American glaze, from the middle position which it occupies, possesses most of the advantages of the soft, and practically none of its disadvantages, and while but little less suited than the latter for the particular work just indicated, is best adapted for every other kind of work, and is therefore to the painter an invaluable description.

10. *Scope of the Amateur's Work.—Special Position of the Amateur.*—Having thus dealt somewhat fully with the special characteristics of the different kinds of wares, and of their glazes, and also noticed the effect of those glazes on the work, it will perhaps be well to say a word or two upon a subject with regard to which much apprehension exists. This is the nature of the work which an amateur may advantageously undertake. It is popularly supposed that because a person does certain work himself, the result is the cheaper by the cost of the labor of whoever would otherwise do it. This is not always the case, and in nothing is it less so than in certain branches of china-painting.

The productions of the ordinary painter, whose wages are low, are in the style of the $10 dessert service, "ornamented with every variety of fruit and flower, magnificently painted by hand," as the advertisements read. Such a man is very useful in his way. In certain lines, indeed, such as call for rapid production and regularity, he cannot well be dispensed with, but with work which demands special artistic ability it is otherwise; the high-pressure rate at which he works precludes the possibility of his improving upon the peculiar style referred to, and that is scarcely, I think, the style which we should like to see exemplified upon our walls or our furniture, or in an article which we would offer as, say, a birthday gift, or a present in token of friendship or gratitude. From him we go by a step to the pottery-artist; but his work is really good, and being, as a rule, expensive, is within the reach of comparatively few. Now it may be presumed that the general amateur enters upon the study of china-painting, primarily with the view

of affording pleasure to himself, and his friends and relations, and herein lies his great strength and the advantage of his position, for he can leisurely devote his energy to the attainment of excellence in any special line for which he has aptitude, and so may develop therein an individuality from which his work may acquire a high intrinsic value in addition to the estimation in which, if it becomes a gift, it may be held from its associations.

Where the design is intricate—other than mere repetition of detail—or fanciful, or of such a nature that the time which would be occupied upon it by the pottery-artist, and by the amateur who has achieved some facility in the use of his brush and colors, would be about the same, or generally of strictly limited interest, the advantages are altogether on the side of the latter, whose taste and fancy may be exercised on objects of the greatest variety. Among the pieces to be had are spill-vases, flower-vases, flower-pots, breakfast-cups and saucers; especially, if I may make a suggestion to some fair student, moustache-cups, often most acceptable to the recipient; dessert and tea-services in which the decoration is elaborate, or contains much miniature or variegated gold work, afternoon tea sets, plaques of various shapes, round, oval, oblong, or square, and suitable for pictures for wall decoration, such as scenery, or family portraits, for covers for albums, for inlaying in clocks and cabinets, or for setting as brooches or in bracelets, dishes for the wall or for setting as card trays, dress buttons, solitaires, etc., etc. These, and the paintings on them, might be all objects of special interest; and the articles named are only a few of those which the amateur may decorate with most advantage.

11. *Principle of Selection.*—These considerations reveal the principle which should guide the amateur in selecting his work, if he would not be at a loss both of time and of money. He must emulate the true artist, not the mere painter. He must engage in work which appeals to his head as well as to his hand, not in what is only routine or mechanical.

What to Avoid.—At the pottery there is opportunity for the greatest economy in the use of paint, and every convenience is at hand for firing the painted article with the least delay, as often as may be necessary, and at the smallest expense. Hence, in the painting of a tea, coffee, chocolate, dinner, dessert, or toilet-service, which may have to be fired more than once, and which consists of several pieces, the decoration of each of which may be after a set design of whatever kind, it will be found that the work can be done better, more cheaply and more quickly at the factory, than at home—the standard of work being of course regulated by the cost.

(To be continued.)

An "Arrangement in Brown Paper."

Suggestions for Inexpensive Framing for Prints and Etchings.

BY J. W. GLEESON-WHITE.

DURING a past dispute between two men of light and learning, concerning the merits and demerits of certain harmonies in blue and silver, and arrangements in grey, a brochure was issued in defence of his works by the artist who considered himself insulted, clad in covers of homely brown paper, which was happily nicknamed by the phrase I have taken for my title—one which, from its utter lack of any definite hint of the subject, may be, to an ordinary mind, in keeping with the first cause of the pamphlet itself.

But the arrangement here to be talked over and suggested (though by chance first applied by myself to a charming etching by Whistler) has no other connection with the *cause celebre* than a vague trace of the picturesque, and refers to a somewhat novel application of an old rough and ready way of framing pictures that has often been used before, but hitherto chiefly in connection with very common and small articles, pictures only by courtesy, proving, however, capable of a different treatment, and admired by many artists and art lovers; it has been also (sincerest flattery) imitated by nearly every person who has seen it, that to the many who now may first make acquaintance with it, it will, I hope, prove acceptable from its two great merits—cheapness and simplicity.

In almost every home now one finds prints, etchings, pencil drawings, or photographs, sometimes issued with a popular periodical, or reminiscences of travel that are, while not quite worth framing, yet too good, or with too pleasant associations to destroy. These linger on, having no definite place, never to be found when required, and helping rather to litter than beautify the house, until they ultimately disappear in that mysterious visitation, known familiarly as the "spring cleaning," when so many valuable treasures swiftly and suddenly vanish away, and never are heard of again. If these forlorn pictures were once framed or kept with the intention to do so at a quiet time, not only would they be spared the sad end to which I have referred, but the habit of taking care of them once formed, would lead to the finding and saving many other suitable subjects. It is astonishing how any idea once adopted

finds unexpected possibilities arising out of the ordinary events hitherto unnoticed, and until one begins collecting any object, it seems that there must have been less of it in the world, by the sudden appearance in hitherto unsuspected quarters, of desirable and very often easily procurable specimens.

But without further preamble it will be best to explain the proposed method. Take an ordinary drawing, or print, or photograph. Mount the picture with ordinary paste on a piece of smooth cardboard. Any color, plain or printed, will do if it has only a fair surface, and enough thickness to withstand the warping; let this cardboard be the size of the print (that is, the actual black and white picture, regardless of the margin it possessed in its first state) with an outer margin of equal width all round. In "Touched," the print itself is $5\frac{3}{4}$ by $7\frac{3}{4}$ inches, allow a clear 3 inches each side, making the size of the mount $11\frac{3}{4}$ by $13\frac{3}{4}$ inches, paste the picture (without cutting off the old margin, as it may be useful for references and will be hidden) in the exact centre. Then take a piece of the grey mottled cardboard, now so much used and so easily obtained, cut from the centre a piece either $5\frac{3}{4}$ by $7\frac{3}{4}$, or $6\frac{1}{4}$ by $8\frac{1}{4}$ inches at will. Some prefer the grey mount to touch the picture everywhere, others like a narrow white border with the name of the artist, etc., showing. This is, I think, only to be decided by the character of the drawing, as some are much improved by allowing no other white than that left in the drawing to destroy the value of the tones of the picture itself. Having cut the grey mount, take a piece of rough cardboard, the top of a paper box or other available material, cut it $11\frac{3}{4}$ by $13\frac{3}{4}$, and at the distance of $\frac{3}{4}$ inch below the top, and say $3\frac{1}{2}$ inches from either side, cut two short upright slits with a sharp penknife, and pass a piece of narrow tape through them; this will lie flat on the surface, and should be tied behind in a knot close to one of the slits, so that a firm and unobtrusive support is left to suspend the picture when complete. Then having procured a piece of glass $11\frac{3}{4}$ by $13\frac{3}{4}$ inches, the size of these three pieces of board, lay the cardboard flat on a table, above that place the mounted etching, then over that the cut-out mount, and the glass above all. Next cut some thick brown paper into strips of about an inch or inch-and-half wide; thoroughly paste these and bind the four thicknesses together, the brown paper showing about half an inch all round in the front, and well over the back, being cut in mitre fashion at the angles. When dry it will be ready to hang; and, after cleaning off any paste-marks from the glass, will be found a very pleasing little picture, unpretentious in appearance, the framing being not unlike a plain oak frame at a distance, and an ornament, or at least no disfigurement in itself, apart from the actual etching, in any room it may find itself.

Pictures so treated would be useful not only for the owner's house, but (as I have found) find a very ready and profitable sale at bazaars, and make inexpensive and much-liked gifts for friends; moreover, they also find a warm welcome in the homes of the poor, as any visitor to them knows that a love for pictures, amounting almost to a passion, exists among the most squalid and unlovely surroundings.

The cost of the etching, "Touched," is twenty-five cents, the glass at most twelve cents, the cardboard perhaps five or six cents; so that for little more than thirty-five cents a really beautiful picture may be bought, framed, and hung on any wall. Contrast this with the price for the commonest "Dutch" metal frame, or the once all-popular "Oxford" one, and it will be seen that it is barely half the cost of the frame itself, not counting the print, while the art-beauty of the one is beyond comparison, as a little print in gilt frame is more or less an eyesore anywhere, while this simple substitute is sure to find favor with all or nearly all; and for those who dislike it, I was going to say, so much the worse for their taste, but remembering in time that abuse is no argument, and as a disciple of the "higher culture" (for who, writing under such a heading, could forget the necessity of living up to it?) it is only in keeping to ignore and refuse to allow even the possibility of the other side of the matter—certainly, if monotonously insisting that the "pictchaw is beautiful" be what will be said against it.

But this does not exhaust the possibilities of brown paper. Another way is worth noting. If the old gilded moulding, fly-specked and tarnishing, is well reclothed with brown paper, soaked with paste and well stuck on, so that it shows every feature of the moulding, it gives a very presentable appearance. The paper should be pasted some few minutes before use, and thoroughly moulded on to the wood. Each hollow and fillet will be seen sharply defined, and the whole will dry hard, and, while unlike paper, look somewhat like oak, and present a certain fresh character of its own, not attainable in any other way. In this case the brown paper itself is a pleasant variety to the grey mottled card for the cut-out mount and an ideal setting to many wood engravings, as it gives such value to the blacks and whites of the print, in the same way that a good photograph gains by a dark, dull mount.

A more ornate way of adapting the same idea would be to add to the binding of brown paper a strip of plush or velvet entirely hiding it, and put on after the paper is dry with a touch of glue or bind-all along each edge of the brown paper, the velvet or plush being put on when the adhesive substance is nearly dry or "tacky," as it is technically called. For some subjects the velvet margin might be wider, and touch the line of the drawing or photograph itself with good effect.

To those who live in our larger towns a constant opportunity of picking up suitable engravings presents itself, as almost any old bookstall has some part of an illustrated magazine or frontispiece of an old and valueless book that is well worth securing and utilizing in the way suggested. It may not be an early Durer, a noted Rembrandt, or a Meryan in a fine state, that is to be found; but pictures less valuable, in a money if not an art sense, may often be met with. I came across a copy of Flaxman's "Eight Illustrations to the Lord's Prayer" (an early set), for a few cents; and a nice Bartolozzi or bits of Claude's "Liber Studiorum" are often to be bought (out of the common run of tourists), very cheaply.

And now, in concluding this article, as I run my eye over it and wonder if I have not said too much in praise of my idea, I look up and see a long, low gallery, hung with a greenish-grey paper, with here and there a shelf of blue and white pottery or a few Dutch tiles catching the light. I see that half its charm lies in the pictures that I have framed in the "simple brown paper," and feel that "The Sappho," "Sunflowers" and "Quiet Counsellors" of Tadema, Arthur Moore's "Pansies," Leighton's "Daphnephoria," Burne-Jones's "Studies," and a Meryan ("Notre Dame"), are a true source of beauty and pleasure; for that, if it had entailed the cost of some thirty frames of even the simplest sort of wood, would have been sadly but of necessity foregone; and so with the proof positive so near, I offer no apologies for my much-lauded method, but hope that many a reader of this will follow the example, and thank me inwardly for suggesting this "Arrangement in Brown Paper."

"A New Boy."

BY AN OLD BOY.

THERE is a real and an undeniable awkwardness in most new positions, but of all new positions, that of the "new boy" in a public school is probably the worst. A lad fresh from home and the gentle, refined society of mother and sisters, is turned loose in a large school-room or playground, amongst a noisy, callous throng, of all sorts and sizes, of the *genus* school-boy. It is an ordeal from which the bravest may instinctively shrink—and suffer small reproach in consequence. In a long life many very momentous changes are sure to occur, but in dozens of cases this first will hold its own in the memory right to the very last. It will stand by itself, with its sharp outlines of loneliness, of isolation, of painful diffidence, unsoftened by any lapse of time. The most trivial circumstances and accessories of the starting introduction to a crowded class-room will often be stamped indelibly upon a lad's brain. The ink-stained desk in one corner, the battered books in another, will reappear years after, kindled into life by some like surroundings—just as the scent of a simple faded flower will sometimes bring back to the vision a whole landscape belonging to a long-past holiday trip.

Amongst future schoolfellows first acquaintances are to a great extent decisive. Boys are usually impulsive animals; they quickly rush to conclusions respecting the new-comer, and, having reached them, are not easily persuaded to retrace their steps. What they see—or imagine they see, which practically comes to much the same thing—at the outset colors their views right along the course. Not seldom a nickname is bestowed on the first day of a boy's school career, which clings to him to the final one. Any oddity of his personal appearance, dress, or manners will be seized upon with avidity, canvassed by the whole group, and emphasized until it becomes ludicrous, whether it was so before or not.

Even, sometimes—and one grieves to write it—deformities of physique, over which the new boy has certainly no control, and for which he has no responsibility, will be turned into weapons of bitter humiliation. Boys have scant pity as a class, however it may be individually. Being sturdy and whole of limb themselves, they lack that fellow-feeling with suffering and infirmity which is the foundation of genuine sympathy. It is not always so, of course; there are pleasant exceptions to be found even in schools dominated by the bad moral influence of a Mr. Creakle. But the exceptions, we fear, once again prove the rule.

The rattle of the coach-wheels has died away upon the gravel walk without, and, with the echo thereof fainter and fainter, has grown our new boy's courage. But his wits are soon fetched back from wool-gathering. The babble of voices that at first has been vague and indistinct in his ears resolves itself into a very tempest of questions, some *bona fide*, some satirical; some kindly, some threatening; some

easy to answer, some that he would do much to escape.

One lad wants to know his age, another how his "ma" was when he left her. One is curious respecting his wisdom teeth, another as to what supplies of pocket-money the neophyte can command. A fat, unctious-cheeked boy asks if he has any prime tarts in his box; a gloomy, austere one inquires, with an air of mystery, if he likes *stick liquorice.* Woe betide the tyro if, confused and baffled by this ordeal, and with his strange sense of desertion pressing in keen pain upon his heart, he should burst into tears. His prospects of future popularity will go under a cloud immediately, and many days will pass before the episode is forgotten. The designation of "milksop," thus earned accidentally, and very probably without reasonable desert, will stick. The handkerchief to a new boy's eyes acts on his comrades very much as the proverbial red rag on the nerves of a bull.

The best advice to the tried one upon this point is to maintain self-control at any cost—to take the questions calmly, and answer just as many as he may find convenient. Do not be over reticent unless there should be valid cause for reserve. To give confidence is the surest way to obtain it. And, on the other hand, guard carefully against "gush." In a group of lads there will often be one who can insinuate himself into very sacred recesses of a new boy's heart and draw from him confessions and little innocent stories that will afterwards be used against him as the spoils of a rude mirth. It is well to be on guard against the wiles of this provokingly sympathetic individual. He will then soon give the game up and show himself in his true colors.

Then comes to the new boy the important period of what are euphemistically spoken of as "larks." All sorts of games will be played upon him. His ignorance of school routine will be taken advantage of in a dozen different ways. Many schools have an unregistered but nevertheless rarely varying code of tricks for the tyro's delectation. Just as the merchantman's apprentice has to endure the details of a stereotyped ceremony on first crossing the Line, so the new scholar at "Our Academy" will be sent on a fool's errand here, and will endanger his shins by an unsuspected pitfall yonder. It will be best and safest to take it all in good part, and to refrain from anything approaching grumbling. If the unlucky one laughs persistently at disaster, and mildly edges his way out of blunders, the idea will quickly get afloat that there is good stuff in him, that he is a "real brick."

Never—except in the most unlikely, serious, and aggravated of all cases of practical joking—take the step of appealing to the authorities. To have fastened upon you at the very beginning the name of "tell-tale," "sneak," will be absolutely fatal, in nine instances out of ten, to any chance of school happiness. It is far better to bear in silence. Even should there be a downright bully in the school he will surely grow tired of his amusement, if he can raise no response of anger or supplication. Be patient, and all these petty annoyances will blow over. Games with new-comers are not confined to schools *pur et simple.* They are found wherever young life congregates.

I knew a young man some time ago who thought he had a mission to become a preacher of the Gospel, truly the highest and holiest of all callings. He was an artisan and uneducated, but friends worked him up, and by-and-by, with much effort, found an entrance for him into a training college. He went—after a great flourish of trumpets—but returned crestfallen in less than a fortnight. He used some singular excuses to account for his disappointing *fiasco*, but from hints dropped to acquaintances the opinion grew that practical jokes had been played upon him, as a new-comer, and in his loneliness these had driven him back to his bench—there very probably to vegetate for life.

I knew, too, a boy who tried the plan of telling the head master about tricks played upon him after lock-up, and who found no more peace until his father fetched him away, amidst the jeers (shown in every look and word and attitude) of those who, in happier circumstances, might have become his fast and life-long friends.

In school life, as in the wide arena beyond, it pays best to practice endurance, meekness, and good temper under trial. Let any new boy whom it concerns remember this in the hour of his temptation and his difficulties.

Lastly—for space has vanished—when in your turn you form one of a group to receive "a new boy," have in recollection the days of your own novitiate, and be gentle and considerate accordingly.

Spartan, the Newfoundland Dog.

BY RUTH LAMB.

AMONGST the many four-footed friends of whom I have delightful memories, my father's Newfoundland, "Spartan," stands out conspicuously. What a beauty he was! Large enough to serve as a steed for a little boy; gentle enough to bear any amount of pulling and hauling about by the youngsters. Black, with white breast, throat, and paws, and a tail like a great plume with a snowy tip. One

could not say he wagged that tail. He waved it.

It was a sight to see Spartan stretched full-length on the rug with two large cats lying across him, to say nothing of Leo, a waspish Italian greyhound, that wanted to drive away the cats and have Spartan's great body for his own sole resting-place.

Spartan could have throttled Leo and crunched up the cats with perfect ease, but instead of doing so he let them have their own way, only giving them a lazy glance sometimes, when the dog snarled and the cats swore a little more loudly than usual, as if he wondered they could be so stupid as to quarrel about trifles.

How that much-enduring beast was kissed, hugged, pulled about by his master's children! How droll it was to see him, when he missed his master, steal into the forbidden territory, the drawing-room, where hung a good portrait of him, and seem to find comfort in gazing at the copy in the absence of the original.

Spartan and his master spent several happy years together, and travelled thousands of miles in company.

Once they suffered shipwreck on the return voyage, and after an absence of several months from home. The vessel during a dense fog got aground on the "Knock Sands"—near neighbors to the famous "Goodwins."

The seamen got out the boats, but my father resolved to stay by his ship so long as there was the smallest hope, and at first refused to leave it. The men begged him to go, and at last two of them tried to force him into the boat.

Spartan was the pet and playfellow of every man on board, but he could not permit the best amongst them to meddle with his master. When the first sailor laid hold of the captain, the grand dog flew at him, and, in less time than it takes to tell, laid him flat on his back and held him until my father bade him leave go.

Then the great fellow laid down at his master's feet with a menacing air that seemed to say, "Try that again, if you dare."

The men lingered with the boats, and as the case soon became hopeless, my father at length left the doomed vessel. But he was not quite the last to quit the ship, for Spartan saw him safe in the boat, and then leaped in after him.

When telling us the story of that shipwreck and of Spartan's doings, my father's eyes used to light up with pleasure as he spoke of the grand, old Newfoundland. And we children, never satisfied without hearing just a little more than the story, wanted to know what my father saved beside his life and Spartan when his good ship went down. A smile played on his kind face as he answered, "Well, only three things—my old violin, a MS. written by my uncle, whose namesake I was, and this."

"This" was his pocket Bible. I have it to-day—every leaf yellow, and most of them stained with salt water, his firm, handsome writing on the fly-leaf. But I think there have been some salt drops on the pages that did not come from the sea. And in going over the list of articles saved from the wreck—when money, instruments, all that most men would have thought precious, were lost—one reads the character of the man. Here I will stop. I began to tell about the dog, but somehow I fancy those who read Spartan's brief memoir will leave off, thinking most of Spartan's master.

House Plants.

POTTED plants should not be wet too often. They should not be watered until they really need it. It will be evident that they require wetting, if in taking the earth from the pot it crumbles to pieces like dust; a sure sign is to knock on the side of the pot, near the middle, with the finger knuckle. If it gives forth a hollow ring, the plant needs water; if there is a dull sound, there is still moisture enough to sustain the plant. Plants must not be wet more than once or twice a day; on dry, clear days they require more water than on damp, cloudy days. On the other hand the earth must not be allowed to dry out entirely, for that is also very injurious. In wetting them the water must be poured on in such a way that it will run out again through the hole in the bottom of the pot. If the earth gets too dry, it is best to place the pot in water, so that the water will saturate the dirt very gradually. They may be watered at any hour of the day, except when the sun is shining on the pot or has just left it; for the earth gets hot when the sun shines on it, and then if cold water is poured on it, it will cool off too rapidly. Keep them free from dust, if possible. Cover them over at sweeping time. If the plants are on a table, contrive an upright post or stick to be set in a hole in the middle of the table to hold up the centre of a spread of some kind that will cover the plants. In the absence of such protection, contrive some method of using old newspapers. Before sweeping protect the plants by the use of a covering, and let this remain over them until the dust has completely settled. All smooth-leaved plants, especially ivy, cape jessamine, camellias, and the like, should have their leaves washed with a soft sponge—a rag will answer—on both sides, with tepid

water, at least once a week. If this is once tried it will be found much less trouble than one would suppose, and the increased beauty of the foliage will lead to its repetition. Rough-leaved plants, such as geraniums and many others, cannot be washed to advantage. Set these in a bath-tub, or in a sink, and give their leaves a good drenching by using a garden syringe, if one is at hand, or else a watering-pot, one with fine holes, holding it up high, so that the water will fall with force upon the leaves.

Our Girl's Department.

This department is intended exclusively for "Our Girls," and we hope to make it both interesting and instructive, and to this end we ask our young lady readers to assist by contributions, suggestions, or illustrations. There are thousands of little things that can be, and have been, made and done by young ladies, pertaining to decorative art, needlework, etc., etc., that would be gladly followed but for a want of knowledge on the subject, and we know of no more pleasing task for a lady than that of teaching her younger sisters that which they are anxious to learn, and which may prove of real benefit to them in the future, as well as being useful and interesting for the present. We trust we will have no difficulty in persuading those who have something nice to show or speak of, to make use of this department. Remember, it is open to all, and if you have anything worth knowing suitable for this column, send it along, and we will give it our best attention. Do not be afraid to write because you may fancy your composition is not perfect, or have other scruples of a similar kind. Do the best you can, and leave the rest to the editor of this department, and we are sure you will be pleased with your work.

ONE of the saddest things about human nature is that one may guide others in the path of life without walking in it herself—that she may be a pilot and yet a castaway.

—Welcome hither, as is spring to earth. *Shakespere.*

—A generous friendship no cold medium knows; burns with one love, with one resentment glows.—*Pope.*

—It's no in books, it's no in lear,
To make us truly blest—
If happiness has not her seat
And centre in the breast.
We may be wise, or rich, or great,
But never can be blest.
Burns.

—A new style of vase has a surface imitating pearls, over which is a design of water lilies.

—Gold-fish globes in Austrian crackle glass show fresh designs in violets, fern sprays, and delicate flowers generally.

—A mossy surface, which is given to chinaware, aids the pleasing effect of flowers in relief straying over the pieces.

—A pretty toilet-piece is a rose-tinged shell, opening and disclosing a bottle, also in the pottery, entwined with wild roses.

—A unique lamp-shade may be made of a straight piece of bright-colored silk or satin. Shirr the top to fit the globe, and finish the bottom with lace.

—Corner closets and corner "cupboards" are revived, and utilize space, especially where it is limited. They ought to be more common, and not so difficult of achievement.

—Flower decorations are taking on conventional forms, much brilliant color, very little foliage, and a formality that is quite in keeping with the solemnity of a dinner-party.

—Hall lamps are now square in shape and made of beautifully-designed colored glass, each panel being different. Usually they are mounted in brass and suspended by a short chain or pole of twisted brass.

—Pretty lambrequins may be made of the Aida linen canvas worked in long stitches of olive, pink, gold and blue. On either side of this is black velvet ribbon, feather stitched on with gold silk.

—A handsome table cover is made of the basket flannel now so much in vogue. Take a square of it in crimson or olive and work a pretty border in bright silks. Finish with a fringe of crewel wool tied in around the edge.

—For a banner screen a new idea is a design on discs. These are cut out in satin and appliqued on to deep-toned plush or velvet, while designs of flowers or fruit are worked upon them in filoselles or crewels.

— A tidy that will prove both handsome and durable is made of three stripes of zephyr Java canvas, two cardinal and one of drab. Each stripe is worked with a pretty vine and the ends cut in points. The red pieces are crocheted around with drab and the drab with red. Sew the stripes together, having the drab in the middle, and tip each point with a tassel of wool of the color of the stripe.

— For mantle valances the pleasantest work is done on the coarse linen canvas called "Aida canvas," and wrought in double cross-stitches with single zephyr wool. This work grows rapidly, and is simple and easily done. The fringe is knotted when bought, and the worker ties in wools of different colors in each strand of the fringe; a border of drawn work is placed above the fringe.

— Eastern inlaid applique, used for covers, carpets, and housings, is chiefly made at Resht. It may be briefly summed up as patchwork made with embroidery. The colors used are among the most brilliant, and the patches, which are of cloth, are cut so small, and into such intricate patterns that it is marvelous how they can be joined together. Flowers, birds, and animals are freely used, besides geometric and other patterns. The pieces are stitched together, and every seam afterward concealed with lines of chain-stitch worked over them with colored silks. Not content with a single line of chain-stitch, two or three lines upon each petal of a flower or feather of a bird are embroidered, and each line is worked in a different colored silk, while in many places the entire patch is concealed with embroidery either of gold thread or silk, worked so as to make a shaded design. Frequently, instead of chain-stitches, lines are made with fine gold threads, not laid on flat, but twisted into very small circles, laid so as to form a broad compact line. Gold and silver foil is used instead of gold or silk; it is cut very narrow and folded so as to form zigzag lines, which are then sewed to the foundation, either as lines or to fill certain spaces.

FLORICULTURE FOR JUNE.

"And now the earth prolific swells
With leafy buds and flowery bells;
And all along the branches creeping,
And through the velvet foliage peeping,
Little infant fruits we see
Nursing into maturity."

From the Greek.

The flower harvest has begun. We have come with a stride into summer. But Nature has been at work while our short spring lasted, and the garden bears witness to her bountiful preparations for summer's reception. We must get up early now to keep pace with the daily growth of even our little piece of the world.

Now is the time to make a bargain with summer, to this effect: "If I will give an hour or so before breakfast to making my garden a credit to you, will you give me a little insight into your ways of doing things, and in the end a pretty garden to show for my pains?" I think summer will come to terms with you; she is by nature generous. Your part of the bargain means that you put on a shade hat and garden gloves (though *I* never could work in gloves), and weed, water, and rake every morning, making the toilet of your garden as conscientiously as you do your own.

Your early-planted seeds, etc., should be growing well and beginning to blossom. If you are not tired of planting, you can provide flowers for the dreary days of late autumn by planting seeds of aster and zinnia now, and some strong gladiolus bulbs. You certainly should have a few of the last, and also a plant or more of scarlet salvia; nothing makes a more brilliant display or is more certain to do well.

Don't be chary of picking your early blossoms. The saying "There is that scattereth and yet increaseth" is beautifully exemplified in the flower-garden; you will have more flowers and finer if you keep them well picked off at first. Verbenas and pansies are notable instances of this. Leave a pansy bed alone for awhile, and it will be covered with long-stemmed seedpods, and what flowers there are will be small and poor, and

quite unlike the earlier blooms. Geraniums, too, look very untidy when the flower stalks are left on them, and mignonette soon runs up long seedheads unless it is picked and kept making new growth too fast to think of seeding.

Water your garden thoroughly early in the morning and after sundown. Look out for insects in the early morning when you go your rounds. Soapsuds on rose-bushes and verbenas will help keep off insects; the florist uses whale-oil soap. You will have to use a syringe to get at the under side of the leaves. To destroy the little black flea which eats up sweet alyssum, sweet pea, etc., soon after they come up, dust the plants over with soot.

See how one thing leads to another. Do you not begin to feel by this time how much use you could make of a microscope, a work on entomology, or one on botany?

I have thought that there might be people in the city who got "left behind" this spring with their window gardening through being occupied with the horrors of "moving," or because the changeable spring weather misled them, and summer was upon them before they knew it. They have thus lost the pleasure of raising their plants from seed, but can still, with the florists' aid, make their windows gay, and keep them so by their own skill and care. If you mean to have a window-box, get lobelia, nierembergia, tropoelum (major and minor), mignonette, coleus, heliotrope, verbenas, and (if there is any room left) geraniums and sweet alyssum. These all like a hot sun. If you can raise a trellis, or have some sort of arched handle arrangement on your box, plant maurandia to grow over it; nothing is prettier or grows more rapidly. Maderia vine or German ivy will grow well in a sunny exposure, and the lysimachia or common moneywort makes a pretty fringe for a box.

Have a fine-nosed watering-pot for your window garden, and keep your plants as free from dust as possible. Water twice a day in sunny weather, and let your morning watering be done *early*, before the sun is hot.

As for old plants of geranium, fuchsia, or roses that bloomed for you last winter, if you cut them back a month or so ago, and withheld water from them for awhile, they may begin to grow again now. Wash and scald their pots thoroughly, scrubbing off all the green mold. It is sometimes a good plan to crumble off a little of the old soil and mix in fresh, instead of potting in larger pots. Do not expect blossoms off them, but pick off any flowers that appear; then if the plants make a good strong growth, in July or August you will be able to make cuttings from them which will give you fine plants for next winter.

Have you ever tried to make a living screen? Fix castors on a box the length of the window you wish to screen, and at the ends place uprights of the height you desire; then place a bar or stretch a wire across the top, and at the bottom a few inches above the box, connecting the uprights; from one to the other of these stretch strings or wires; then plant German ivy, Madeira vine, smilax, or maurandia on each side of them, and train up the strings.

This screen can be turned occasionally to give both sides the benefit of the sunshine.

A screen of maurandia, showing a mass of green and pink or green and purple, according to the variety you have planted, and with its outreaching sprays forming a thousand graceful curves round the edge of the frame, and throwing the loveliest shadows, is a pleasant object in a city house. Small screens, that you may roll between you and the sun which shines in your eyes while writing or reading, may be made the same way, by fixing flower frames of suitable shape and size in small boxes on castors. The vines having once grown will preserve their beauty for a long time.

Who knows what brilliant fancies you may not have the honor of originating! This is but one of a thousand "dainty devices" which an acquaintance with the flowers will prompt you to.

As Edward Youl says twice over in his lovely spring poem, "Friendship with the flowers some noble thoughts begets!"

Ellen M. Hooper.

THE

Young Scientist.

A Practical Journal for Amateurs.

(With which are incorporated "THE TECHNOLOGIST," "THE INDUSTRIAL MONTHLY," and "HOME ARTS.")

PUBLISHED MONTHLY AT $1.00 *PER YEAR.*

EDITORS.

JOHN PHIN. FRED. T. HODGSON.

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Removal.

WE take this opportunity of informing our friends that we have removed our editorial and business offices to 294 Broadway, New York, where we have secured a suite of spacious and pleasant rooms.

It will give us pleasure to have any of our friends call and see us whenever they can make it convenient to do so.

Our printing-office is situated at No. 15 Dey street, and is therefore some distance from our editorial *sanctum*, which is a much better arrangement than the former one, when the printing, editorial and business offices were in one building.

The increase of our business within the last few years has rendered a removal to more spacious quarters imperative; and in responding to this requirement we have been fortunate in securing the rooms we now occupy for a term of years, a condition that will warrant us in expending a reasonable sum in fitting-up our offices in a suitable manner, an undertaking that would be unwise under a short lease.

A writer on mechanical subjects advises young mechanics to cultivate the nerves and muscles of each hand, so that they can use a hammer, chisel, wrench, file, or any other tool, as well with one hand as with the other; so that they can turn a handle or hand wheel one way with one hand, and another one the other way with the other hand, both at the same time; or so that they can turn them both one way or different ways at different speeds. Such practice in turning handles will be found indispensable in learning to become an expert on the lathe, planer or other machine tool. All that is required to learn this is a little practice until the motion of one limb or member is not at all governed or controlled by the motion of another. There are many things that may be done with one hand as well as the other, but there are some instances when the time required to educate one hand to expertness is as much as the owner can afford. Indeed, for some of the finer manual operations it requires half a lifetime to educate the hand to perform its duties satisfactorily; and to accustom both hands to perform the same performances alike must, as a matter of course, take a great deal more time than if one hand was prepared to do the same duty. Ambidexterity for ordinary operations is to be desired, but for the finer order of artistic and mechanical manipulation, though desirable, is not to be sought after, as the pursuit would be simply a waste of precious time.

The telephone as yet is only in its infancy, yet what wonders have already been performed with it! A few weeks ago a number of very successful experiments were performed in the Postal Telegraph Company's office, New York. The telephoning was between New York and Chicago, and the instrument used was the double Edison telephone, which was employed four years ago in establishing communication between Toledo and Milwaukee by way of Detroit and Chicago, a distance of over 500 miles. It consists of two Edison telephones attached to a single mouthpiece in such a manner that

one can talk into both at the same time, and get their combined effect upon the line connecting the two. It seems to matter little, however, what instrument is used, for the various experiments that have been made with different points at a great distance have all been attended with similar results. It is thought, therefore, that the great success attained must be attributed to the compound copper wires of the Postal Telegraph Company, through which the sounds are transmitted. They consist of a core of steel surrounded by a coating of copper, so combining the strength of the ordinary wires with the conductivity of the copper covering. With these wires there appears to be no limit to the possible use to which telephones can be put. Every word that was said in the Chicago office could be heard as distinctly as when using the wires that run from office to office in this city, and the operators in Chicago were able readily to distinguish the voices of the gentlemen in the New York office. We see no reason why some of our boy readers cannot construct telephones in their own houses, or from there to the houses of some of their near friends. Telephones are easy to make and both useful and amusing, as a great deal of innocent fun can be taken out of them when known friends are at each end. In future issues of the YOUNG SCIENTIST we intend giving this subject our attention, and hope to give such instructions and illustrations as will enable many of our readers to construct telephones of their own.

We believe it was John B. Gough who said that "if you want to succeed in the world, you must make your own opportunities as you go on." Young people who are always waiting, Micawberlike, for "something to turn up," wait long and wearily. It is folly of the most idiotic kind to sit by the wayside and wait for some one to invite you to ride in his carriage to prosperity and fame. We are sure none of our readers—boys or girls—are of the dillydally sort, that are afraid to take hold of work in all its phases, and persistently stick to it until a satisfactory end is attained; but it may be that some of our young friends may not be the worse for reminding that thoroughness, expertness and competency are only obtained by persevering and persistent workers, and that, without these qualities, no opportunities for honest advancement are possible. It is only the competent and industrious that can make opportunities and take advantage of them. There is no rest for the prosperous, and there is none required, for to be busy is to be happy, and to be happy is to be good and useful.

Our Book Table.

The Engineer's Slide-Rule and its Applications. Being a complete investigation of the principles upon which the slide-rule is constructed, together with the method of its application to all the purposes of the practical mechanic. By William Tonkes. Industrial Publication Company, New York. Paper. Price 25 cents.

This excellent little treatise on the engineer's slide-rule is an advanced companion of work manual No. 2, "The Mechanic's Slide-Rule, and How to Use it." Both are particularly good works for mechanics, the one under notice being especially adapted to the wants and requirements of students in mechanical and civil engineering. Young men who are preparing themselves for following any of the constructive pursuits would find it very much to their advantage to become acquainted with the workings of the slide-rule. The study is not a difficult one, and when once mastered, is capable of being applied with exceeding rapidity to the solution of some of the most tedious and irksome problems. Indeed, the slide-rule, in the hands of an expert, is a kind of an elastic calculating machine, and is made to perform some of the most difficult and perplexing feats in mathematics with a minimum of labor. The book under review explains how these things are accomplished, and tells the reasons why the solutions may be performed by the rule clearly and in the simplest of language.

The American Boy's Handy Book. What to do and How to do it. By D. C. Beard. Chas. Scribner's Sons, New York, 1882.

This is really what its title claims it to be: "The American Boy's Handy Book." The object of the work is to teach boys not only how to use their toys and playthings, but also how to make and care for them, and this, we think, the author strives to do in an easy and pleasing manner. The chapters on kites are clear and interesting, and the instructions given for making these aerial playthings are simple and to the point. So also are the instructions for amateur boat-build-

ing, fishing, camping-out, private theatricals, and the other matters the book discusses. Indeed, we know of but few other books we would prefer placing in the hands of our boys sooner than the one under notice, for from the preface to index there is not a line that does not contain some useful hint or idea that, if followed out, would surely lead to moral health and active usefulness. If more books of this kind were found on the tables in our households than there are, and less of the "goody-goody" trash on the one hand and of the "scalp-taking, blood-and-thundery" kind on the other, we should have fewer boy criminals and more solid, sensible, and useful men. We are fully in accord with the author, who, in his preface, says, "Let the boys make their own kites and bows and arrows; they will find a double pleasure in them, and value them accordingly, to say nothing of the education involved in the successful construction of their homemade playthings. The development of a love of harmless fun is itself no valueless consideration. The baneful and destroying pleasures that offer themselves with an almost irresistible fascination to idle and unoccupied minds find no place with healthy activity and hearty interests in boyhood sports."

The Metal-Worker Pattern Book. A practical treatise on the art and science of pattern-cutting as applied to sheet metal work. By A. O. Kittredge. David Williams, publisher, 83 Reade street, N.w York.

The modern tendency to apply sheet metal to many purposes heretofore never dreamed of, has rendered it imperative that workers in this material should possess an accurate knowledge as to the manner of cutting out patterns and shapes for the multifarious forms they may be called upon to execute.

A number of books have been written with a view of enlightening the workman on this subject, and aiding him to obtain good result with as little expenditure of labor and material as possible, and no doubt these books did good service in their time; but the art of sheet metal working, like all other mechanical arts, kept advancing, and new methods and new ideas have developed with each step advanced, until the old methods and manners of manipulation are become obsolete and valueless. The work before us has been prepared to meet present wants and present practices, and is thorough, reliable, comprehensive, and is, withal, written in a plain and simple style, and in language that any mechanic should understand. The work is divided into five general chapters. In the first, definitions and technicalities are considered. The second discusses drawing tools and materials, while the third takes up geometrical problems and their relations to pattern-cutting. The fourth describes the art and science of pattern-cutting, and the fifth and last consists chiefly of illustrated methods of solving the various problems of every-day practice. The work is profusely illustrated, well printed, and handsomely and substantially bound in cloth. The book is one that can be recommended, and will prove invaluable to mechanics who work in sheet metal.

Astronomy for Amateurs.—June.

BY BERLIN H. WRIGHT.

THE PLANETS.—JUNE, 1883.

(All Computations are for the Latitude and Meridian of New York City.)

Venus, in her eastward march past the stars, passes between the Pleiades and Hyades about the middle of the month, and is one and one-half degrees south of the Moon on the 2d. She will pass very close to the planet Saturn on the 19th, being, when nearest, only about one-half of a degree north of him. They can both be brought in the same field of a telescope, and thus make interesting objects. Venus' shape will be somewhat oval, as about nine-tenths of the diameter of her illuminated hemisphere will be visible. She rises as follows:

10th—3h. 6m. morn.
20th—3h. 4m. "
30th—3h. 7m. "

Saturn is about five degrees north of *Alpha Tauri* (*Aldebaran*), and with Venus, the Pleiades and Hyades makes a very conspicuous cluster of bright and interesting objects. The Moon will be in their midst on the morning of the 4th, almost occulting Saturn, passing just below him. He rises on the 10th at 3.40 morn.; 20th, 2.29 morn.

Mars is west of the Pleiades, rising as follows:

10th—2h. 24m. morn.
20th 2h. 4m. "
30th—1h. 46m. "

The Moon will be in conjunction with him on the 2d and 30th, passing very close and south of him in both instances. He will be 1° 7′ north of Neptune on the 27th.

Jupiter, being in conjunction with the Sun on the 5th of next month, will be too near the Sun to be well seen this month.

OCCULTATION.

The first magnitude star, *Alpha Virginis* (*Spica*), will be occulted by the Moon on the 15th. The immersion will occur at 1h. 13m. in the morning, Washington mean time.

METEORS.

The meteors of June are as follows: First, The Aquilids, which radiate from a point near *Alpha Aquila* (*Altair*), about midway between that star and Job's Coffin, east of it. They are slow-moving, and extend over a long period, beginning on the 7th. Second, a group radiating from *Alpha Cepheus*, beginning about the 11th and running through the month. Third, The Draconids II., radiating from the first coil of Draco,

beginning on the 28th. Fourth, The Pegasids II., radiating from a point about midway between the second magnitude star, *Alpha Pegasus* (in the southwest corner of the Square of Pegasus), and the λ of Aquarius. The earth enters this group on the 28th also. Fifth, The Coronids, radiating from a point five degrees south of the beautiful little cluster known as the Northern Crown. The earth passes out of this group on the 30th.

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS, JUNE 22, 1883.

	H.	*M.*
Alpha Andromeda (Alpheratz) rises	10	8 eve.
Omicron Ceti (Mira) variable, "	3	26 mor.
Beta Persei (Algol) " "	11	48 eve.
Eta Tauri (Alcyone or Light of Pleiades) rises	2	12 mor.
Alpha Tauri (Aldebaran) rises	3	31 "
Alpha Aurigæ (Capella) "	0	50 "
Beta Orionis (Rigel) invisible.		
Alpha Orionis (Betelguese) invisible.		
Alpha Canis Majoris (Sirius or Dog Star) invisible.		
Alpha Canis Minoris (Procyon) sets	7	50 eve.
Alpha Leonis (Regulus) sets	10	43 "
Alpha Virginis (Spica) sets	0	43 mor.
Alpha Bootis (Arcturus) in merid.	8	8 eve.
Alpha Scorpionis (Antares) in meridian	10	19 "
Alpha Lyrae (Vega) in meridian	0	34 mor.
Alpha Aquillae (Altair) rises	7	13 eve.
Alpha Cygni (Deneb) in meridian	2	38 mor.
Alpha Pisces Australis (Fomalhaut) rises	0	52 "

Penn Yan, Yates Co., N. Y.

Novelties for Amateurs.

A very ingenious device for attaching small hooks to walls has recently been brought out by W. H. Hasbrouck, No. 91 Liberty street, New York.

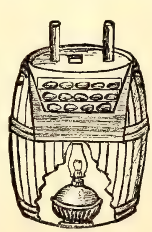
The device consists of a piece of strong paper, printed and cut to some appropriate design, as shown in the cuts. The paper is covered with some strongly adhesive gum on the back, and a small wire hook, having two prongs, is fastened to the paper by the prongs passing through the paper and being bent over or "clinched" on the back side,

The second cut shows a few of the designs

made, but there are styles such as ivy and autumn leaves, and other elegant designs lithographed in brilliant colors.

The adhesive hooks can be used in many places where tacks or nails cannot be driven at all; as on stone or brick walls, metal surfaces, glass, etc., and are easily put up, as they only require to be moistened on the back and pressed firmly against the wall or other surface for a few moments, when they are ready for use. For light articles, such as small pictures, plaques, calendars, match-boxes, almanacs, time-tables, show-cards, brushes, toilet-cases, catch-alls, watches, etc., they are a decided improvement over nails or tacks, and in no case whatever do they disfigure a wall.

For hundreds of years it has been the custom of the Egyptians to hatch chickens by artificial means; the first country in Europe to adopt this method on a large scale was France. About ten years ago it was introduced into America, and now thousands of chickens are hatched in incubators in the vicinity of New York every year. This system has several advantages over the old way. The time occupied by a hen in setting and rearing a brood of chicks is about three months; this occurs at the season of the year which is most favorable for laying. During this time she would probably produce sixty or seventy eggs—another advantage being to secure early birds for the market, when broilers are worth from fifty cents to one dollar per pound. There is no occupation more pleasant or profitable to boys on farms or in villages than rearing chickens. It requires very little capital, and the returns in cash from sale of eggs and chickens will make an easily-earned income.



There are several manufacturers of incubators and artificial mothers; all are expensive, ranging in price from $25

to $600, while the principle of constructing one is so simple, that any boy with ordinary genius can construct one himself at a trifling expense.

The above cut represents one of the cheap homemade kind. It contains every principle in which the more expensive ones are made, excepting in two particulars—it is not self-regulating, and it has not the arrangement by which all the eggs can be turned at once. It requires very little care and attention and does its work well.

Paul Gustave Dore.

Gustave Dore, the famous painter and designer, died in Paris, Jan. 23rd. Paul Gustave Dore was born in Strasburg in January, 1832, and received his early instruction in the lyceums of that city and of Bourg. Before he was twelve years old he had developed a wonderful facility with the pencil, and at a very early age he contributed comic sketches to the *Journal Pour Rire* and other popular newspapers. His education was completed in Paris, and while still a schoolboy his work was recognized as giving more than ordinary promise. His first great work, however, was produced during the period of the Crimean war, and was illustrative of battle-scenes. He exhibited "Les Pins Sau vages," "Le Lendemain de l'Orage," "Les Deux Meres," and "La Bataille d'Alma," in 1855; and "La Bataille d'Inkermann," in 1857.

Dore was, in fact, a precocious wonder. He could draw when a child, and when success came to him, it came with a rush. Before he was twenty-five he had illustrated "Rabelais" and the "Contes Drolatiques" of Balzac, and had given rein to his wild and and fantastical humor in a series of grotesque yet powerful drawings illustrative of the legend of the "Wandering Jew." In rapid succession followed his illustrations of "Montaigne" (1857), Taine's "Voyage aux Pyrennes" (1859), Dante's "Divinia Commedia" (1861), Chateaubriand's "Atala" (1862), "Don Quixote" (1863), "Paradise Lost" (1865), the "Holy Bible" (1866), Tennyson's "Idyls of the King" (1866–'67), and La Fontaine's "Fables" (1867). It is by his illustrations that Dore's highest excellence as an artist will be recognized, and his "Don Quixote" and "Dante" were magnificent efforts.

Dore was a most versatile genius, and al though not as successful in color as in black and white, some of his figure pieces were of considerable merit. In addition to those already named, his most noticeable works in oil were the "Paolo and Francesca di Rimina;" the "Gambling-Hall at Baden-Baden;" the "Neophyte" (1868); the "Triumph of Christianity;" and his most ambitious group, the "Christ Leaving the Prætorium," an immense picture, covering a canvas thirty by twenty feet, which was exhibited in London and elsewhere. Dore was a tireless and indefatigable worker, and is said to have executed not less than 50,000 designs. He had a gallery of his own paintings in Paris, another in New York, and another in London, where his "Christ's Entry into Jerusalem," "The Flight into Egypt," "Spanish Peasants," "Mont Blanc" and other works were shown. At the Paris Exposition in 1878 he exhibited a colossal vase, ornamented with 150 figures. One of his latest works was a sculptural group, "The Prize of Glory," a young hero dying beneath the kiss of glory. He was decorated with the Cross of the Legion of Honor, Aug. 15th, 1861. At the time of his death he was engaged on a series of illustrations of Shakespeare, and among his latest labors must be included his Poe's "Raven," now in press. He was a sculptor as well as a painter, and had just finished his monument to the elder Dumas, which is considered as one of the finest works of art produced in this century. M. Dore was never married.

Scientific News.

—Many persons are puzzled to understand what the terms fourpenny, sixpenny, tenpenny, mean as applied to nails. Fourpenny means four pounds to the thousand nails, sixpenny six pounds to the thousand nails, and so on. It is an old English term, meaning at first tenpound nails (the thousand being understood); but the old Englishman clipped it to tenpenny, and from that it degenerated until penny was substituted for pounds. So when you ask for fourpenny nowadays you want those which will weigh four pounds. When a thousand nails weigh less than a pound they are called tacks, etc., and are reckoned by ounces.

—An English work gives the origin of the "Oak and Ash Tradition" as follows: If the oak gets into leaf before the ash, we may expect a fine and productive year; if the ash precedes the oak, we may anticipate a cold summer and unproductive autumn. In the years 1816, '17, '21, '23 '28, '29, '30. '38, '40, '45, '50 and '59 the ash was in leaf a full month before the oak, and the autumns were unfavorable. In 1831, '33, '39, '53 and '60, the two species of trees came into leaf about the same time, and the years were not remarkable either for plenty or the reverse. But in 1818, '19, '20, '22, '24, '25, '26, '27, '33, '34, '35, '36, '38, '42, '46, '54, '58 and '69, the oak shows its foliage several weeks before the ash, and the summers of those years were dry and warm and the harvests abundant.

— Joseph Albert, photographer to the court at Vienna, has finally succeeded in inventing photography to render the natural colors in the picture by a photographic steam press of his own construction, without the aid of a pencil. An expert painter could hardly give the colors of the object more faithfully in living reality and with the distinctness to the nicest shades than in these colored photographs by the Albert press. The secret of the invention consists in the analysis of the white light into three colors, yellow, blue, and red, and in the recovery of the three colors ready for the press. On a plate, chemically prepared so as to receive but the yellow parts of the light, and the tones of the colors of the object to be reflected, the first photograph is taken, when a negative of that plate is at once put under the press, whose cylinder is dubbed over with yellow paint. None but the tones of the yellow colors are now seen in the impression. After that the object is photographed on the plate made to reflect but the blue colors. This plate now under the press reflects a blue impression, the cylinder being dubbed over with blue paint. In the same manner it receives but the tones of the red colors by means of a third plate. Printing the individual pictures of the yellow, blue and red over each other, a picture is produced true to nature, the colors intermixing by having been printed over each other. The idea, long entertained and prosecuted by Albert, to photograph colors, may no longer be considered as not feasible. It is very hard at the present time to foretell how great a revolution this new invention will produce in the many departments of art.

Practical Hints.

Cement for Fastening Wood to Stone.—Melt together 4 parts of pitch and 1 of wax, and add 4 parts of pounded brick-dust or chalk. It must be warmed before using, and applied thinly to the surfaces to be joined.

To Produce Imitation Ebony.—Take half a gallon of strong vinegar, one pound of extract of logwood, a quarter of a pound of copperas, two ounces of China blue, and one ounce of nutgall. Put these into an iron pot and boil them over a slow fire till they are well dissolved; when cool the mixture is ready for use; add a gill of iron filings steeped in vinegar. The above makes a perfect jet black, equal to the best black ebony. A very good black is obtained by a solution of sulphate of copper and nitric acid; when dry, the work should have a coat of strong logwood stain. —*Bitmead's Practical French Polisher.*

To Imitate Ground Glass.—Put a piece of putty in muslin, twist the fabric tight, and tie it into the shape of a pad. Well clean the glass first, and then apply the putty by dabbing it equally all over the glass. The putty will exude sufficiently through the muslin to render the glass opaque. Let it dry hard and then varnish. If a pattern is required, cut it out on paper as a stencil plate, and fix it on the glass before applying the putty; then proceed as above, and remove the stencil when the dabbing is completed. If there should be any objection to the appearance of clear spaces, cover them with slightly opaque varnish.

Notes and Queries.

In continuing this department, which has been found of so much value, we would remind our readers who wish for information on any of the arts and sciences, that they are cordially invited to make their wants known through this column, and those of them who can furnish accurate answers to questions asked are requested to send in replies. Doubtless many of our subscribers may know of methods, processes, or devices that may be better or more suitable for the particular case in question than anything generally known, and it is this reason that induces us to keep this department open for a medium, where an interchange of ideas and practices may be made to the advantage of all our readers. Correspondents will please send their full address when forwarding their communications—either questions or answers—not for publication, unless expressly so stated, but so that we may know where to find the writer if desirable. Communications should be sent in on or before the first of each month previous to publication, to insure insertion in next issue.

Answers.

71. Oil Colors.—A set of materials and oil colors for flower painting could be made up for from five to eight dollars. You could paint on paper or on wooden panels. If you desire the former get a sketch block for oil painting, which contains 32 sheets, seven by ten inches, for a dollar; ten by fourteen inches for two dollars. If you prefer wood you can get polished panels from forty cents up to $1.60 apiece. You can order at Devoe's, corner of Fulton and William streets, New York, sketch of daisies for plaque. You can also order at same place all your materials mentioned; also "Tilton's Outline Studies of Familiar Wild Flowers," in two parts, $1.50 each part; and "Tilton's Familiar Garden Flowers," in two parts, each part illustrated by twenty chromo-lithographic plates.—Nettie, N. Y.

72. Steamboats.—A kind of a steamboat was patented in England in 1737 by a man named Hull. His patent, and a pamphlet written by him setting forth the great advantages of his invention, are still in existence. Jouffroy tried Hulls' idea on the Saone at Lyons in 1782. Miller, of Dalswinton, and Symington, tried their steamboat on the Clyde in 1789, and accomplished seven miles in the hour. The Charlotte Dundas steam-tug was placed on the Forth and Clyde Canal in 1801. A barge was propelled by steam on the Thames, at two miles an hour against tide, on July 1, 1801. Fulton's steamboat was tried, and collapsed, on the Seine, August 9, 1803. Having visited Symington, and taken notes of the Charlotte Dundas, Fulton tried again, and successfully, on the Hudson at New York, with one of Boulton and Watt's engines sent out to him from England in 1806, since which time steamboats have always been on the Hudson. The improvements made in steam engines by Boulton and Watt rendered successful steamboating possible. The Comet, the first passenger steamboat in Great Britain, started on the Clyde in 1811; the Norwich and Yarmouth boats began in 1813, the London and Gravesend boats in 1815. The first steam-packet to cross the Atlantic was the Savannah, which reached Liverpool in twenty-six days from New York on July 15, 1819. The first English steamer from London to New York was

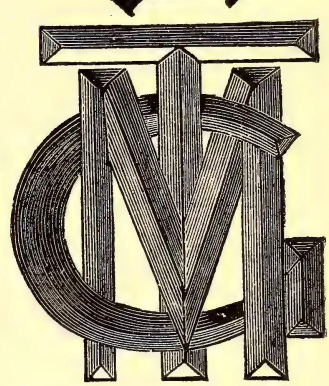
the Sirius, in 1838. The Sirius on this occasion took out Dr. Lardner, who had spent a vast deal of time in "proving the voyage impossible!!"—ONE JENKINS.

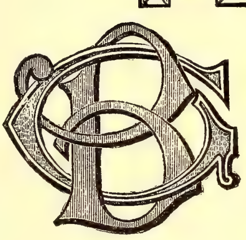
73. THE END OF THE WORLD.—The end of the world is your own death, as far as you are concerned, and it is wise to be always ready for that. No man can fix a date for such an event. The year 1000 was to see the end, but it did not. De Cusa pledged himself to 1704, Swedenborg to 1757, Bengel to 1836, Miller to 1843, Cumming to 1866, Mrs. Shipton to 1881, and there have been many others, and the world lives on and laughs at them. We are not aware that there are any impending predictions at this time. There was a report a few years ago to the effect that Proctor, the astronomer, had predicted that the earth and some comet would collide, resulting in a complete smashing-up of the former. Proctor, however, denied the report. We are inclined to believe that for the future it will be best for timid people to remain satisfied on this point and await events, for it is not likely that any sane person will again predict the exact time when the general break-up of the earth will take place.—CLERICUS.

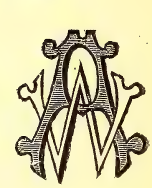
74. PAINTING PHOTOGRAPHS.—Thirza McB. should procure the following for painting photographs in ordinary water colors. Gouache or Chinese white is generally used. The colors necessary for this will be Chinese white, yellow ochre, rose madder, cobalt, sepia, light red, vermilion, black, gamboge (or cadmium). The surface of the photograph is prepared by washing it over with a size which comes for that purpose, and can be procured of any dealer in art materials. The whole of these materials, or any of a like kind, may be obtained in this city—New York—at Devoe's, Fulton street.—AMATEUR.

75. GLASS.—The Hebrew word *zechuchith* is employed to denote "glass." Whether it has this signification in Job xxvii., 17, or whether it relates to some precious stone, is a debatable question. The word *zechuchith* means a pure substance, which does not imply transparency. The Phœnicians, though credited with the invention of glass, have not left any other records except the names of some makers of glass vessels. On some Phœnician relics occurs the name of Artas the Zidonian. Whether the Jews, as neighbors of the Phœnicians, were manufacturers of glass during the Biblical period of their history cannot be proved by any relics. Of glass which came from Assyrian excavations, the British Museum has several specimens; one of 700 B.C. bears the inscription of Sargon. A more direct insight is given by the Egyptian monuments, where we have pictorial representations of glass-making. The earliest relic brought from Egypt bears the inscription of Thothmes III., and was made 1500 B.C. The Coptic name of glass, *badjiein* or *abadjein*, and some variations of this word have no connection with Semitic words. The Arabs have given a wide extension to the word *zajaj* or *zagag* among Mahometan nations. But among the Aryan Mahometans in India, in Persia, in Kurdistan, as also among the Turks, glass is called *shish*. In Hebrew *shish* or *shayish* is the name of marble, and may eventually have been used in the signification of glass. Whether glass was in the earliest days manufactured in Palestine or not, glass vessels must have been known to the Jews. This is not solely to be inferred from the circumstance that the Palestine Exploration Fund has brought to light numerous fragments of glass vessels, for such vessels may have been made at a late period, but it is an indubitable fact that the Phœnician traders, according to the testimony of the Bible (Proverbs xxxi., 24, and Hosea xii., 8), constantly came to Judea to offer their wares. Israelite women liked to adorn their necks with glass beads. Specimens of such ornaments occur everywhere; note for example the specimens found in the tombs of the Egyptians and the Etruscans. Among the treasures which Dr. Schliemann discovered at Hissarlick, the so-called site of Troy, and again in the graves of Mycenæ, Egyptian or Phœnician glass beads have been found. Even beneath the lakes of Switzerland, where the pile buildings of ancient inhabitants have been brought to light, glass beads were discovered, which none but Phœnician traffickers could have carried to Switzerland, just as they brought them into the lands of the ancient Britons. No doubt can therefore exist that the Hebrews of the earliest date were fully acquainted with articles made of glass.—EZRA.

76. MONOGRAMS.—We take pleasure in publishing the annexed **monograms: G. B., M. D. H.,**







L. F. R., W. A., W. W., M. G. T., and G. E. T. We have received several other monograms, which are simply duplicates to those presented.

Queries.

77. CORNER SHELVES.—Would like some instructions regarding a corner bracket or corner shelves, which I desire to have put up in a room. I desire to have them neat and well-finished, but not too expensive. Any one who has had any experience in these matters will oblige me very much by giving me such information as they may think I may need.—JESSIE S.

78. CATAMARAN.—In the April number of the YOUNG SCIENTIST there is an article on cheap boats, and in it is mentioned a catamaran, which is recommended by the writer as being cheap, fast and safe. Can you or Mr. O'Grady give any further information regarding this kind of a craft? If you would publish some it would confer a favor on—LAKE ERIE.

79. SOFA AFGHAN.—I am about to make a sofa afghan. I want some ideas as to length, colors, and stitch best adapted for the purpose; also quantity of wool necessary, and what kind. Will some one who has had satisfactory results kindly give me the benefit of her experience?—CONSTANCE.

80. FRAMING PHOTOGAPHS.—I have a photograph which I desire to frame myself, but am at a loss in deciding how to frame it. I can do the manual part of the work well enough, but would like to have a few hints as to materials and arrangement. Would any of your readers be kind enough to assist me?—BIG BOY.

81. LANGUAGE OF PRECIOUS STONES.—I thank you very much for answering my query (21) regarding trees and flowers, and am encouraged to still further trespass on your good nature by asking for a reply to the following question. What is meant by the "language of precious stones?"—MATILDA.

82. MONOGRAMS.—A. M. wants a monogram of the above initials for inlay work, and asks Bostonian if he will kindly design one and publish it. Monograms are also desired for E. H. H., J. H. J., L. H. H., and T. T. H.

83. FORCING PLANTS.—H. H. Field desires to know how plants may be *forced* to bloom and to early maturity.

NOTE.—"H. H. Field" might get a more satisfactory answer if the variety of plants wished to mature had been named. One way to produce *blossoms* in an early stage of a plant's growth is to cramp the roots by potting in a small pot, pinch off buds that appear weakly, water with liquid manure, and give sunshine plentifully. Some plants run all to leaf when fed with mixed drinks, and need starving to make them bloom. H. H. F. can see that to bring a lettuce, a lily, and a lilac-bush to maturity would require three distinct modes of treatment.—E. M. H.

Market Report.

Retail Prices.

IMPORTED CAGE BIRDS.

Canaries, *Belgian*, per pair	$6.00 to 15.00
" *French*, per pair	6.00 to 15.00
" *German, Hartz Mts.*, each	2.50 to 10.00
Gold Finches, each	1.50
Gold Finch (mules), each	2.50 to 5.00
Bull Finches, not trained, each	2.50
Bull Finches, trained to sing two tunes, each	10.00 to 40.00
African Finches, per pair	2.50 to 5.00
Chaffinches, each	1.50
Talking Mino or Mina	10.00 to 25.00
Linnets, each	1.50 to 2.00
Linnets (mules), each	2.50 to 5.00
Green Linnets, each	1.50
Java Sparrows (blue), each	1.50
Java Sparrows (white), per pair	6.00 to 8.00
English Sparrows, per pair	1.00
Siskins, each	1.00
Gray Cardinal, each	4.00 to 5.00
Nightingales, each	8.00 to 25.00
Japanese Nightingales, each	5.00 to 10.00
Thrushes, each	5.00 to 7.00
Skylarks, each	5.00
Troopials, each	7.00 to 12.00
European blackbirds, each	5.00 to 7.00
Black-caps, each	4.00
Starlings, each	4.00 to 6.00

PARROTS.

Gray Parrot	10.00 to 15.00
Single Yellow-Head Parrot	8.00 to 12.00
Double Yellow-Head Parrot	10.00 to 15.00
West Indian "	4.00 to 5.00
Cockatoo (white)	18.00
Australian Shell Paraquets, per pair	6.00
"Love Birds," African Paraquets, per pair	6.00
West Indian Paraquets, per pair	3.00 to 5.00

All birds that are accomplished singers or talkers bring high and "fancy" prices. Parrots are rated by the number of words, sentences, and tunes they have learned.

AMERICAN CAGE BIRDS.

Canaries, each	2.50
Mocking Birds, females, each	1.00
" " singers	12.00 to 25.00
Robins	2.50 to 5.00
Blue Birds ("Blue Robins") each	1.50
Indigo Birds, each	1.00
Nonpariel, each	1.50 to 2.00
Virginia Cardinal, each	2.50 to 3.00
Bobolinks, each	1.50 to 2.00
Yellow Birds, each	1.50 to 2.00

Prices Paid by Dealers.

Robins, per hundred	12.00
Blue Robins (Blue-Birds), per pair	0.35
Indigo Birds, each	0.50
Bobolinks, per dozen	3.00
Yellow-Birds, per hundred	12.00
Orioles, per hundred	25.00 to 35.00
Virginia Cardinals (Red-Birds), each	0.75 to 1.00
Nonpareils, each	0.75
Blue-Jays, each	0.35
Scarlet Tanagers, each	1.00
Red-Winged Starlings, or Black-Birds, each	0.25
Woodpeckers ("High-Holers"), each	1.00
Partridges, each	1.50
Cranes, each (according to variety)	10.00 to 20.00
Wood-Ducks, per pair	2.50
Wild Bronze Turkeys (one cock, two hens)	10.00 to 15.00

FANCY POULTRY.

Guinea or Pea-Hens	12.00
Pheasants, *English*, per pair	20.00
" *Golden*, "	35.00
" *Silver*, "	30.00
Pea-Cocks, per pair	20.00 to 75.00
Bronze Wild Turkeys	15.00 to 20.00
White Turkeys	10.00 to 15.00
Bantams, trio	3.00 to 10.00
Ring-Doves, per pair	1.50
Pigeons, *common*, per pair	0.75
" *all white, common*, per pair	1.00

BIRD FANCIERS' MATERIALS.

Breeding Cages (double)	1.50 to 4.00
Trap Cages	0.75
Wire " painted	0.50 to 4.00
Wood and Wire Cages	1.50 to 4.00
McAllister's Mocking-Bird Food, 1lb. jar	0.35
" Canary-Bird Food, 1lb. box	0.20
" Mixed Bird Seed, 1lb. box	0.10
" Extra Silver Bird Gravel, qt. box	0.10
McAllister's Prepared Fish Food, per box	0.10
" Song Restorer, for birds, per bot.	0.25
McAllister's Bird-Lice Destroyer, in patent bellows box	0.25
McAllister's Bird Lime, per box	0.25
Cuttle-Fish Bone, each	0.05
Meal-Worms, per hundred	0.40
Nest Boxes, wire and tin	0.10 to 0.15

QUADRUPEDS.

Terriers, *black and tan*, each	5.00 to 30 00
Terriers, *Scotch and Skye*, each	5.00 to 30.00
Newfoundland Pups, each	10.00 to 15.00
Pomeranian or Spitz "	5 00 to 15.00
Greyhounds, *English*, "	10.00 to 25.00
Greyounds, *Italian*, "	10.00 to 30.00
Guinea-Pigs, *common*, per pair	1.50
" " " " large	1.50 to 3.00
Guinea-Pigs, *all white*, "	2.00
Squirrels, *gray*, "	5.00
Squirrels, *all white* "	15.00 to 25.00
Squirrels, *flying* "	3 00 to 4.00
Squirrels, *small red* "	2.00
Rabbits, *common*, per pair	1.00 to 2.50
Rabbits, *fancy breed*, according to age and purity of breed, per pair	3 00 to 15.00
Ferrets, *English*, "	15.00
Raccoons, each	4.00 to 5.00
Cats, *Maltese* (males), each	5.00
" " (females), each	3.00
Cats, *Albinos, pink or blue eyes*, each	3.00 to 5.00
Rats, *white China, pink eyes*, per pair	1.50
Rats, *piebald*, per pair	1.50
Mice, *white, pink eyes*, per pair	0.50
Mice, *piebald*, per pair	0.50

Prices Paid for Pet Stock by Dealers.

Guinea-Pigs, per pair	$0.40
Squirrels, *gray*, each	0.50
Squirrels, *flying*, per pair	0.75
White mice, per pair	0.15
Monkeys, according to variety	15.00 up.

MARINE AQUARIA STOCK.

Purple Bermuda Anemone	2.00
Fringed Sea Anemone, Medium-sized specimens	1.50
White-Armed Anemone	0.50
Small Orange "	0.10
Buccinum Snails, per dozen	0.25
Silver Shrimp, each	0.10
Small Hermit Crabs, each	0.15
Small Spider Crabs (decorating)	0.15
Very Small Edible or Blue Crabs	0.20
Barnacles, each	0.15
Nest-Building Stickle-Backs, three and nine-spined, per pair	0.30
Sheepshead Lebia fish	0.25
Killie-Fish	0 10
Eels	0.10
Sea-Horses, each	3.00
Pipe-Fish, "	0 25
Serpulæ, per mass	0.75
Small Edible Mussels, per mass	0.25
Sea Cucumbers	1.00
Sertularia, per mass	0.25
Tubularia, per mass	0.25

ALGÆ (SEA-WEEDS), FOR THE MARINE AQUARIA.

Ulva, per mass	0.25
Solaria, "	0.25

FRESH WATER AQUARIA STOCK.

Stickle Backs, Nest-building, per pair	0.30

Plants, per bunch	0.15	Small Turtles, each	0.25
Shells, per quart	0.50	Snails, per dozen	0.10
Small Dip-Nets	0.50	Frogs, each	0.15
Aquaria Cement 1lb.box	0.30	Fresh-Water Mussels	0.05

Valisneria Spiralis, per bunch	0.25	For the Microscope and Fresh Water Aquarium.
Nitella-Flexilis, "	0.25	
Anacharis, "	0.15	
Ball Plant (Utricularia)	0.15	

Small Rock Sun-Fish, Rock-Fish, Sun-Fish, Dace, Cat-Fish, Tadpoles, Eels, Lizards, each	0.05

Gold-Fish, medium size.	0.15	These are all varieties of the golden carp or gold-fish.
" fountain size.	0.25	
" very small	0.15	
" three-tailed	0.50	
Pearl-Fish	0.25	
Silver-Fish	0 05	
Japanese King-gio	2.00	

Prices Paid by Dealers.

Aquarium fish, per hundred	1.50
Gold Fish, per hundred	5.00 to 6.00
Aquarium Plants, per hundred bunches	2.00

BEAUTIFUL AND INTERESTING AQUATIC AND SEMI-AQUATIC PLANTS FOR ORNAMENTATION OF PONDS, LAKES, AQUARIA AND FOUNTAINS.

White Water-Lily, per root	0.25
Yellow " "	0.25
Arrowhead Lily, 6 plants	0.25
Calla-Lilles	0.25
Pitcher-Plants, per root	0.25
Fresh-Water Cattails, per root	0.25
Giant Rush " "	0.25
Floating Heart (Limnantheum), per root	0.25
Calamus (sweet-flag), per root	0.25
Water-Cress, cuttings	0.25
Jack-in-the-Pulpit, 6 bulbs	0.25
Lobelia Cardinalis	0.25
Large, Showy Blue Lobelia	0.25
Water Violet (very curious)	0.25
Antipyretica Gigantia, interesting	0.25
" Fontinallis, interesting	0.25
The Water Net	0.25
Large Living Frogs	0.10

SHELLS.

Collections of small "cabinet" shells for schools, private cabinets, range from $5.00 to $50.00.

Mother-of-pearl shells, for painting, 75 cts. to $1.50.

Single specimens of cabinet shells range from 15 cts. each to $3.00.

Masses of corals, 25 cts. to $3.00.

Green snail and cowry, with the Lord's Prayer engraved on them, 50 cts. to $2.50 each.

Conch shells, for mantels or hearthstone ornaments: West India Conch, 25 cts.; East India Yellow Helmet, $1.00 to $2.50; Bahama Black Helmet, 50 cts. to $1.50; Bahama Hatchet Helmet, 50 cts. to $1.25. These shells are also for cameo engraving. Zanzibar Cameo, 25 cts. to $1.00.

Ground and polished shells: New Zealand Green Ear, 50 to 75 cts.; New Zealand White Ear, 50 to 75 cts.; Japan Black Ear, 50 cts. to $1.00; California Red Ear, 75 cts. to $1.25.

Fine shells for fancy work, according to colors and variety, per quart, $1.00 and up.

Fancy Wood for Scroll Sawing.

The prices given for the various woods used in this work are for the best of qualities of seasoned material, planed on both sides, ready for immediate use. They can be furnished in quantities to suit purchasers. Prices are by the square foot, and vary according to thickness of material.

		THICKNESS.		
DESCRIPTION.		1-8	3-16	1-4
Black Walnut	Per Ft.	7	8	10
White Holly	"	10	12	14
Oak or Ash	"	8	10	12
Mahogany	"	10	12	14
Red Cedar	"	10	12	14
Rosewood	"	18	20	25
Satinwood	"	25	30	35
Birds'-Eye Maple	"	15	18	20
Tulip	"	30	40	50
Ebony	"	50	60	70
Cocobola	"	20	25	30
Amaranth	"	20	22	25

BEST IMPORTED SAW BLADES. 5 INCHES LONG.

Sizes to No. 6, per dozen	10c
" " " gross	$1.co
" No. 7 and 8, per dozen	15c
" " " " gross	1.25
" No. 8 and 10, " dozen	20c
" " " " gross	1.50

For all information on this subject, as to reliable dealers, etc., etc., send postal card to Young Scientist, When desired, the goods can be sent through this office, but in all cases remittances must accompany the order.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business matter in letters or cards they are filed away and never reach the printer.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

"Crystallography" (40c.); "Electricity" (40c.); "Selection and Use of Microscope," abridged, (30c.) Either in exchange for "Workshop Companion," or two for "The Microscope," by Ross, or offers. C. H. Denniston, Pulteney, N. Y.

A printing-press, chase 5½ by 7 inches, in good order; will exchange for a large self-inking press or type. A. W. Barrett, Canajoharie, N. Y.

Home Medical Battery, cost $7; Lemair's Field-Glass, No. 2202 of Queen's Catalogue, cost $15.50; Achromatic Spy-Glass, power 25 times. To exchange for books or offers. Emerson Heilman, Heilmandale, Pa.

Silver watch, key-winder and Home Works, for good microscope or offers. Wm. Hodgson, 128 Mangin St., New York City.

A small collection of coleoptera, comprising 100 species and 300 specimens, all correctly named, in exchange f r bird-skins, insects, books, or eggs. Emil Laurent, 621 Marshall St., Phila., Pa.

A small magic lantern, Ruby pattern, with twelve slides, for a good book on Entomology, with illustrations. Willie R. Hotchkiss, Morrisdale Mines, Clearfield Co., Pa.

Wanted, Thompson's "Witchery of Archery." Must be in good condition. Write before you send. J. Anthony, Jr., Coleta, Whiteside Co., Illinois.

A telescope worth $3.50, for a self-inking printing-press and outfit; chase not less than 2½ by 3½ in. Eddie Judd, 260 Connecticut St., Buffalo, N.Y.

To exchange for offers: $20 scroll-saw, Seneca Falls make, $4 Bailey circular plane, set of Auburn metallic planes, brass-bound four-foot rule, fourfold, Traut's patent combined plow, dado, etc., cost $7. F. A. Rappleye, P.O. Box 12, Farmer Village, Seneca Co., N.Y.

Bee Hive wanted; one of the old-fashioned straw "skeps"; say what you would like in exchange. Apis, care of Young Scientist, 294 Broadway, N. Y.

A first-class type writer, in excellent condition, cost $125.00, to exchange for good microscope, telescope, or valuable scientific books; send full particulars. A. B., Box 114, Lewiston, Maine.

A $30 stencil outfit (Spencer's) for a self-inking printing press in good condition, chase about 6 x 9; rich ores and minerals of Idaho for scientific and instructive books, printing press, type, etc. J. P. Clough, Junction, Lemhi Co., Idaho.

Wanted pyrites of iron from Colorado gold mines in exchange for sea shells and other gems; send list of what you have to exchange. S. Ferguson, Eureka Springs, Arkansas.

A banjo in good condition, two pairs of rosewood bones, three splendid games, and a fine set of drawing instruments, for a good cornet, viola, violincello or double bass. L. B. Hill, Kalamazoo, Mich.

Scientific specimens of various kinds for same. Geo. E. Frazier, Caldwell, Ohio.

Lester W. Mann, Randolph, Mass., Box 162, has Demas scroll saw, lathe and tools, emery wheel; $20 worth patterns; Smithograph; large harmonica, cost $1.75; novelties in seeds; for large self-inking press or offers.

10 volumes Chambers' Encyclopædia, American Book Exchange edition (cloth); Bonanza printing press, chase 3 x 5, card type, ink roller; spyglass, power 10 times; for French triplet, 1-5 in., or offers. H. P. Nichols, P. O. Address, Bridgeport, Conn.

A good telescope, also foot-lathe and saw combined, each worth $10 00, for shells, fossils or relics. Independent, Conncautville, Crawford Co., Pa.

Birds' eggs to exchange for others; send list of what you have to exchange. Emil Laurent, 621 Marshall St., Philadelphia, Pa.

Twelve or fifteen volumes of the American Agriculturist to exchange for scientific books or offers. W. H. Osborne, Chardon, Ohio.

J. D. Rice, P. O. Box 473, Trenton, N. J., would be pleased to correspond with mineralogists for the purpose of exchanging specimens and ideas.

To exchange, my collection of nearly half a thousand rare postage stamps with catalogue, for second-hand Flobert rifle; must be in good condition. H. E. Whitman, Station M, New York.

I have a large assortment of foreign stamps to exchange, also Confederate money. Collectors send sheet and I will return it with mine. Box No. 2, Coeymans, N. Y.

Electric bell engine, cost $15; pair of analytical scales, cost $10; pair of Bell Telephones to exchange for a printing press, watch or offers. Geo. N. Bigelow, Box 754, Palmyra, N. Y.

Any person wishing to trade bird's eggs may apply to me and I will send them my list of bird's eggs. I have only a few at present, but am receiving a number every month. A. G. G., Box 26, Summit, New Jersey.

Minerals of Idaho for Standard Works on the Horse—Wallace's Registers and turf journals. Wanted, also other useful books, bound and in good condition. Many varieties named in my list. J. P. Clough, Junction Lemhi Co., Idaho.

To exchange for offers first four (fifth when completed) bound volumes of YOUNG SCIENTIST. J. N. Brooks, P.O. 1468, N. Y. City.

Wanted engraver's tools with book of instructions, for a Victor Press, with cabinet, 2 type cases, type, ink roller and furniture complete; perfectly new. L. Warren, 72 Cumberland St., Brooklyn, N. Y.

A Fletcher Foot-Blower, cost $5, as good as new; will exchange for a Cushman, 2 in or up scroll chuck, or other make; will give a satisfactory trade on the difference in price, if any. Louis Lutz, St. Clair Street, Toledo, O.

I have a lot of "Galaxy" (magazines) which I would like to exchange for an air rifle in good condition, a collection of birds' eggs, or offers. W. B. Greenleaf, 480 La Salle Ave., Chicago, Ill.

I have a Mechanical Telegraph with book of instructions, books, etc., which I wish to exchange for good microscopical objects, mounted on 3 x 1 slips. Address, with list, J. H. Frey, Millersburg, Ohio.

To exchange, "How to Use Microscope," Wells' "Natural Philosophy," and many other books, chemical apparatus, etc., for good photographic camera, and lenses. W. H. Weed, 254 Putnam Ave., Brooklyn, N. Y.

Wanted "Quimby's New Bee Keeping," for "Our Own Birds of the United States," by W. S. Baily; new. Joseph Anthony, Jr., Colota, Whiteside Co., Ill.

Wanted a good book in anatomy, in exchange for a book on chemistry, or for story books. A. G. G., Box 26, Summit, New Jersey.

A German-silver trimmed, patent lined, cocoa flute, cost $4, in good order, for good spy-glass, photo-material, or offers. Ewing McLean, Greencastle, Ind.

I have some fossil shells from the west bank of the Mississippi, to exchange for Indian relics. A. W. S., 187 E. 71st St., N. Y.

I have a magic lantern, Ruby pattern, nearly new, and 5 views; also "Our First Century," bound in leather, cost $7; state what is wanted in exchange. I. N. Spencer, Box. 217, So. Manchester, Conn.

First-class telegraph instrument and attachments, and "Wood's Botany," for bound volumes of periodicals, books, or offers. H. P. Albert, Anderson, Iowa.

Wanted a book on treatment and care of canary, also breeding of same; will give in exchange book named "Market Garden, Flower Garden and Bees," or 40 "Scientific Americans" or "Seaside Libraries;" want also old books. M. J. Mulvihill, Norwalk, Conn.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

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Canaries: How to Keep and Breed Them.—II.

BY GORDON STABLES.

YOU can turn the hen into the breeding-cage—it will be her home; but the male bird must be kept in another cage and in another room. And in this manner they must be kept separate until the breeding season, namely, about the second week of March, if the weather be mild and fine, but not until the last week if it is not so. If you do not attend to this hint illness of the hens and death of the nestlings may be the result, and you will have your labor lost and your hopes all blighted.

Now, some breeders, before turning the male bird into the breeding-cage, place the two cages in the same room and in sight of each other for a day or two. You may do this or not, as you please. I have sometimes thought it did good, but such great authorities as Mr. W. A. Blakston think it quite unnecessary. Anyhow, after you have turned in your birds, in nine cases out of ten they will soon become friendly enough, and the male will commence to feed his mate on the egg and bread-crumbs which you now specially prepare for them. Give them two or three teaspoonfuls of this fresh every day; and it may be as well to mix with it now and then a little maw-seed or scalded summer rape, and now and then a little crushed hemp-seed. A portion of green food will also do good, either groundsel or chickweed. The bread-crumb should be stale, but not old. Lunch biscuit is perhaps as good, if not better, than bread, and a morsel of sponge-cake may be placed between the bars of the cage. Your birds are now properly paired, and matters, we trust, will go on swimmingly. By-and-by the hen will begin to lay, and it is a good plan to remove the egg very carefully each morning, placing it most gently in cotton wool, and substituting, if you

choose, an ivory nest-egg, although this is not at all essential. As soon as the third egg is laid you may restore the others, and the hen will then sit. As a rule, the male will be very kind to her, but instances occur sometimes of males being very troublesome to their mates during sitting time; he must in a case of this kind be kept by himself in the other compartment of the breeding-cage.

The eggs take thirteen days to hatch from the time the hen has been set; but when the nestlings do come out both parents are prouder far than princes, and the male will take at once to assist the hen in rearing their darlings.

You must continue the same food for weeks, until, indeed, the young birds are able to feed themselves with the ordinary bird seed.

It will be as well to keep your breeding-cage in your own room. Always approach the cage gently, and never make startling movements or noises, especially when the hen is sitting. As I have already said, in order to get good results your birds must be each of them in good health at the time of pairing. How are you to know this ? By their actions. A healthy bird is a happy bird—happy, and jolly, and frisky, with a "ten-horse power appetite." See well to the behavior of Mr. Canary after the young are hatched, for there are such anomalies as cannibal canaries.

See, too, that the hen does not sit too closely on the birds, or she may sweat and kill them. If she does this, probably the best plan will be to remove the male, so that she will be compelled to leave the nest to feed herself. Some recommend giving the hen a bath; others place bits of stick about the thickness of stocking-wires inside and across the nest, but not touching the birds; while others, again, think there is no cure for "sweating," as it is termed. My own humble opinion is that the hen herself in such cases cannot be in the best of health, and a rusty nail placed in the water by way of tonic, or a few drops of the tincture of steel, cannot do harm and may do good.

Wean your young birds gradually from the egg-food. I had almost forgotten to say that the breeding-cage ought to contain a good sprinkling of sea-sand at the bottom of it, and some breeders add morsels of old lime.

If you have your breeding-cage in your own apartment you will be sure no one meddles with or frightens your pets, and you will be better able to see that they have always a good supply of fresh water. Do not place the cage in a draught, nor in the sun, but in an elevated warm corner; keep it very clean, and also keep the apartment well ventilated. If the sun shines in at the window, it will do good to place the cage for a short time daily in its rays, but do not forget and leave it there.

Talking of cleanliness, the bird's perches ought to be always free from dirt; so should the feet of your canaries, and the claws must not be suffered to grow long enough to endanger the safety of the eggs.

There are many, many things connected with breeding that I need not tell you here, but which experience will teach you; and whatsoever experience teaches one he is far less likely to forget.

Sometimes a hen canary has a difficulty in depositing her egg; she becomes what is called in common parlance "egg-bound." This arises from a want of tone in the bird, or power of expulsion. To more immediately assist her, she ought, after sitting some time, to have the after-part of the body held over steam—not too hot, remember, else you may destroy her. Or the parts may be oiled with a feather and the steam-bath afterwards tried.

I have advised you to procure strong, healthy parents of the variety you have a fancy for, and of the best prize strain; you will thus have a chance of breeding something really good and worthy of exhibition. But I warn you not to be over-sanguine. It is difficult to breed anything of rare excellence. Anyhow, you can do your very best, and live in hope.

The breeding season commences, say, in the middle of March. Well, it must not last over five months. Make this a rule, and stick to it.

Be very careful with your feeding, and

attentive to the cleanliness of all the bird's surroundings during the breeding season, remembering that the food must be nourishing. When a hen gets delicate it will be judicious to give her a month's rest and a tonic.

The temperature of the apartment where your breeding-cage is placed should be only moderately high, and it should be equable. Never keep birds in a room that is heated by gas, or those terrible abominations called petroleum stoves.

The less luxuriously canaries are fed in ordinary times—when not breeding—the better. Birds of this kind, if kept clean and nice, thrive best on simply what are called the white-and-black canary-seeds. See that they are good and fresh, and free from dust. You may let them have a tiny morsel of loaf-sugar, but the fewer delicacies the better. Be careful to wash out the glass every morning before you place the fresh water in it, and let the bird have a saucer bath every day if it be so minded.

Green food should not be forgotten, but always give it fresh. Groundsel and chickweed are probably the best.

(To be Continued.)

Amateur Carving.

LAST month we gave several examples of amateur carving, executed by some of the students in the Cincinnati School of Design, under the superintendence of Mr. Ben. Pitman. This month we exhibit two other examples executed by students in the same school. The examples shown are simply surface carvings, and are suitable for base-boards, skirtings, or any flat members. The designs are easy to execute, and may be wrought in pine, cherry, oak, walnut, or other suitable wood.

Fig. 1 shows a flower pattern conventionally treated. If handled with boldness, this design makes a very effective baseboard, and if finished as described in our last number, would be as pretty as effective.

Fig. 2 is equally adapted for baseboards, mantel friezes, or window cornices. It is easier to execute than Fig. 1, and therefore more likely to be adopted by the amateur. Care should be taken on the straight lines, for nothing spoils carved work more than broken straight lines or ragged edges.

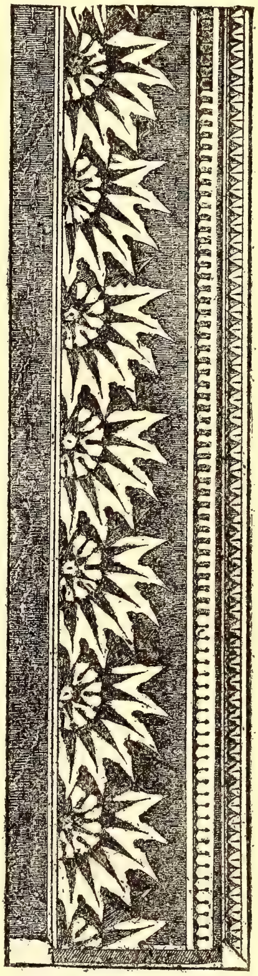


Fig. 1.

CARVED BASEBOARD—FLOWER PATTERN.

Figs. 3 and 4 show two designs of carvings in Moresque style, which is becoming very popular just now. The Mahometan religion forbade ornament, and hence we seldom, if ever, find the slightest effort at natural carving in Moorish architecture or furniture. This, at first thought, would seem to indicate

that the Moresque must be a very cold and geometrical style indeed. But such a notion would be due more to our own freedom of fancv than to any serious restriction actually weighing upon the Mahometan carver. The religious law alluded to in no measure deteriorates Moorish production. On the contrary,

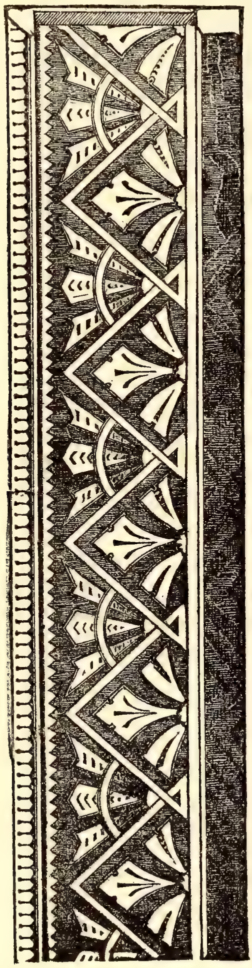


Fig. 2. CARVED MANTEL FRIEZE, BASEBOARD, DOOR-RAIL, OR WINDOW CORNICE.

it has led the Eastern carver to search elsewhere, and has forced him to think more deeply than he would have done had he been free to simply copy nature. Such observation as the Moors indulged in naturally improved their taste, and brought to their notice many methods of procedure which, had they been as free to choose as we are, they, perhaps, would never have known. Thus prevented from copying nature in her integrity, they the more eagerly studied her set laws, and upon these founded one the most beautiful styles of decoration that the civilized world has known. Perhaps the most useful law of nature which the Moors followed in their surface decorations is that of radiation from a parent stem. Every part of the design can be traced to its branch and root, to whatever distance the decoration may go. There is no stopping of the design at one place and starting it again a little higher up, and, what is also of great importance, no foreign or incongruous matter is ever introduced. Vases and festoons, figures and masks, appear in other styles, and are all very well in their way for decorative purposes. It is an open question, however, whether a vase carved upon a panel, with a bunch of healthy flowers growing out of it, is not a little too far-fetched to be classed as high art. The Moors never so indulged their fancies. They commenced their design from the ground, and then, by bending the branches into elegant curves, and filling the interstices with leaves and buds, they generally capped it with some form, either floral or astral.

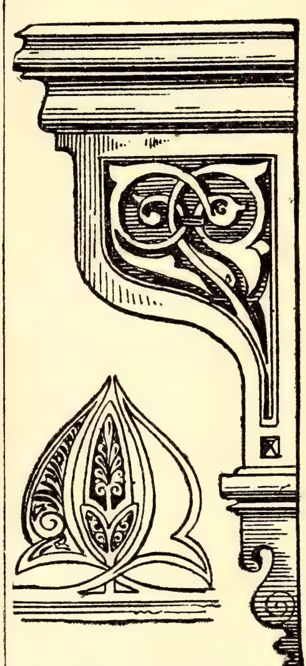


Fig. 3.—BRACKET.

Fig. 3 is a bracket upon which the carving is peculiarly Moresque. There is one

scroll springing from the lower part, swelling outwards and folding inwards. At the completion of the scroll a new member is started in the form of another scroll, which is turned in an opposite direction; then the two scrolls are tied together, and the leaves are thrown out so as to fill up the empty spaces.

Fig. 4 is a drawer front. The design is composed of geometrical bandings overlapping each other and forming panels which are carved, incised or left plain. In the centre, space should be left for the handle.

This design may also be used as a panel design for doors or wainscot, or other suitable places.

Fig. 4.—PANEL OR DRAWER FRONT.

The bracket (Fig. 3) is capped with a moulding consisting of the ogee and chamfer mouldings. These two members are most frequently met with in good work. In preparing Moorish mouldings it is well to avoid the more common curves, such, for instance, as can be struck out with a compass from one centre like the quadrant of torus, and rather to adopt the more subtle lines, such as ogees and the conic sections. We have seen Classic mouldings employed upon modern Moorish work; but although they may suit the eclectic taste of some, they are certainly not true to style. We hope that these few sketches and suggestions will be useful to those amateur carvers who are anxious to become acquainted with Moresque Art.

Glass Making in Ancient Times.

IN the various branches of industry which has been attributed to the ancient Egyptians, superiority is particularly to be noticed in the case of their glass manufactures, from the specimens which have come down to posterity. Thus, in the monumental works executed in the time of the Pharaohs, we find, in addition to glass vases of ordinary shape, small vases (both dull and transparent) ornamented with the richest and most diversified colors, which bear witness to considerable progress in artistic decoration. The form of the lotus-flower in outline and other tasteful ornamentation, in blue on a white ground, is found in these specimens; likewise jars with waved or zig-zag lines in white on blue, or in yellow on a light blue ground, have been found amongst specimens of ancient Egyptian ware.

In giving some comprehensive details on the subject, the *Revue Industrielle* alludes to a small terra cotta figure representing a lion, which may be seen in the Louvre, the eyes of which (formed of incrusted glass) have a life-like expression about them. That the Egyptians were acquainted with the art of glass-blowing would seem established by the sculptures found in the grotto of Beni Hassan-el-Gadim, dating from a period seventeen centuries before the Christian era. In these the process of glass-making is represented in a clear manner. In the vicinity of the Salt Lake there have also been found remains of an ancient glass-making establishment. The industry seems, however, to have concentrated itself in the vicinity of Alexandria. According to Strabo, the glass factories did not require to obtain the necesary materials for their industry from the territory of the Phœnicians, but they used a so-called "glass-making earth," found in Egypt, and without which the manufacture of glass so rich in ornament and in variety of color would have been impracticable.

Etruscan glass decoration, it is remarked, has in some points a resem-

blance to the artistic ornamentation employed by the ancient Egyptian artificers. Chemical analysis shows that the bluish tint so often to be seen in Etruscan glass is produced by cobalt, and this kind of manufacture is stated to have been usual in various important factories.

The fineness of the ware produced in ancient Rome is said to have been marvellous. A glass-maker, who lived during the reign of the Emperor Nero, produced glass vessels of wonderful lightness, which commanded as high a price as about $150 each. Martial speaks of them as "glassy vapor." There is a specimen of this delicate kind of manufacture in the Rouen Museum. It is a drinking vessel of white glass with a handle. Its circumference is 13 inches, and its height 4 inches, while its weight is said to be a fraction under 2 oz.

The Blue Process.

BY JAS. MACDONALD, M.E.

THE introduction of the blue printing process for duplicating drawings, has caused a decided change to be adopted in their preparation. The common practice now is to construct the drawing in fine hard pencil lines, and trace them without being "inked in" on tracing cloth or paper, as the drawing to be copied must be made on transparent material.

The blue printing process is very simple and comparatively inexpensive, and may be practiced by anyone who can procure a piece of plate glass large enough to cover the drawing to be copied. The tracing should be made in good strong black lines. The figures, indicating dimensions, must also be put on plainly; the dimension and centre lines should always be broken or dotted, preferably in red, so that they may be distinguished from the other lines of the drawing, on the blue print. In working drawings, all the dimensions must be given in figures, as no measurements can be made on the blue print. The paper shrinks or changes its shape so much when being washed, that it is no longer a duplicate of the original, so far as size is concerned. The tracing must be kept clean, flat and smooth to insure good work, as any creases or folds in the material will be reproduced in the print. The kind of paper to be used in the blue print, will depend on the use to which it is to be put. Almost any kind of paper may be used, so long as it is white; but for copies of drawings that are intended for office use, to be filed away for reference, or that may be sent through the mails, it is advisable to have thin tissue paper. This will stand a moderate usage, and will fold into a small compass, and may be placed in envelopes if necessary, and filed. For prints that are to be used as working drawings in the shop, or on buildings, a thick heavy white paper is best.

The chemicals necessary for preparing the paper and their proportions are as follows: $1\frac{7}{8}$ oz. citrate of iron and ammonia; $1\frac{1}{4}$ oz. red prussiate of potash. To be mixed with 16 oz. water. The iron and potash should be thoroughly dissolved in the water, and the mixture filtered through bibulous paper. The operation should be performed in a dark room. Keep the mixture from the light. To prepare the paper, it is laid flat on a table, and with a soft brush the surface is coated evenly with the chemical preparation, care being taken to avoid "streaking" or brush marks, as any unevenness of this kind will show in the print. Colored lights, such as from a lamp or gas jet, will not affect the preparation, but it must be kept from the sun or electric light. To take the print, the prepared paper should be laid with the chemical side up on a flat soft cushion, which may be a thick blanket spread evenly on a table; on this the tracing is placed with the blank side next to the paper, and both covered with the glass plate. An exposure of from 4 to 30 minutes, will be necessary according to the intensity of the sun light. If it receives the direct rays of the sun, the paper will turn iron grey in color, after about four or five minutes, and then must be removed quickly. It may now be placed against an inclined surface, and be thoroughly washed by directing a

stream of water against the printed side. In a few moments the chemical that has been covered by the black lines of the drawing will be washed away, leaving the white paper exposed, which will represent the lines of the drawing; the surface of the paper which *has* been exposed, will retain the chemical, and in various shades of blue, according to the amount of time it has been exposed to the light. It is now only necessary to hang the print up, and allow it to dry to be ready for use.

Something About Saws.—VII.

BY "OUR NED."

IN the July number of the YOUNG SCIENTIST I described and gave several illustrations of clamps and other devices for holding and sharpening saws. Perhaps I ought to have shown and described the "saw sets" shown in the present article, for the setting of a saw must be done before the filing takes place, otherwise the teeth will have their fine cutting edges broken away. Every amateur who uses a saw should make a note of the above hint, and in no case set a saw after it has been newly filed.

Sometimes, if a saw is very much out of order, it is roughly filed, so as to give the teeth the right form, pitch and size, before setting; but when such is the case, the saw, after it has been set, is again filed, and the teeth brought up to proper working order.

When a saw is in very bad shape, similar to the illustration shown at Fig. A, in the February number of this journal, it cannot be "set" accurately until the teeth are made the right shape and size; and this can only be done by first jointing the edge of the saw with a fine flat file, cutting down the points of the teeth until the jointing file touches every one of them, and the line of teeth, from handle to point, is straight and regular. When this is done to the satisfaction of the operator, then the rough filing may take place, and proper form, size and pitch given to the teeth, after which the setting process may be performed, followed by filing the teeth to working order.

There are a great number of "saw-sets" in the market, each claiming for itself special merit, but I am of the opinion that there is no tool offered for sale that will set a hand-saw as good as the old-style hammer set, when in the hands of an expert setter.

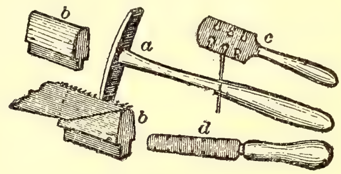


Fig. 1.

Fig. 1 shows the kind of hammer, *a*, the sawmaker generally employs when setting hand-saws. The saw being laid nearly flat, with its teeth along the ridge of a rounded-edged anvil or stake, *b b*, held in the tail vise; the angle is in great measure determined by the curve of the stake, which is, for fine-toothed saws, considerably pointed. Half the teeth having been bent, the saw is turned end for end, and the intermediate teeth similarly treated.

The sets *c d* are commonly employed by the users of saws, requiring less skill to give the proper inclination to the teeth—*c* is used for large, and *d* for small saws. They consist of narrow blades of steel, with notches of various widths, to accommodate different thicknesses of blades. The saw is held between clamps, the alternate teeth inserted a little way into the notch which they most nearly fit, and bent over to the proper angle by pressing the handle of the tool; the operation is then repeated on the intermediate teeth.

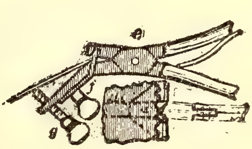


Fig. 2.

Sometimes saw-set pliers, *e*, Fig. 2, are used. These require two adjustments:

one for setting the jaws to the thickness of the teeth, which is effected by a stop held by the thumb-screw *f*; and the other for determining the angle to which the teeth shall be bent, which is regulated by the thumb-screw *g*.

Fig. 3 is so constructed that it may be stuck in a hole in the work-bench. The punch *C* is pivoted to the stock, and is struck by a hammer. The gauge *D*, against which the points of the teeth rest, graduates the position of the saw in accordance with the length of the teeth and in relation to the hammer. The blade rests on *H*, whose vertical adjustment determines the degree or *set*.

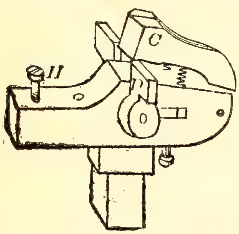


Fig. 3.

Fig. 4 is another form of bench implement, in which the punch is placed in a socket of the adjustable spring. The saw-rest has an inclined lower side, and the brackets vary in elevation to suit, so that the rest can be moved endways to alter its elevation and the set of the saw, such movement not destroying the horizontality of the upper edge of the rest.

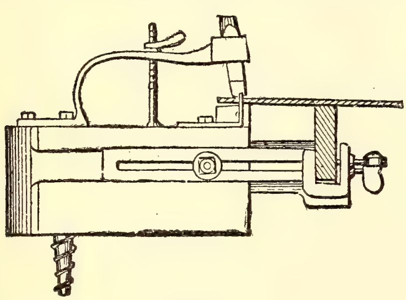


Fig. 4.

Fig. 5 shows another set suitable for putting in a bench. It is on the hammer principle, and can easily be adjusted to give the requisite set by raising or lowering the two set-screws.

Hand-saws may be set very well with a small punch or nail-set. Place the blade of the saw on a piece of hard wood; then take a small punch, putting the flat end of it on the tooth to be set; strike the top of the punch a short, sharp blow. Examine the tooth; if all right, go over the other teeth in a like manner, giving each tooth the same sharp blow. If the set is too much, strike lighter; if too little, strike heavier. Go over every other tooth first; then turn the blade over and repeat the process.

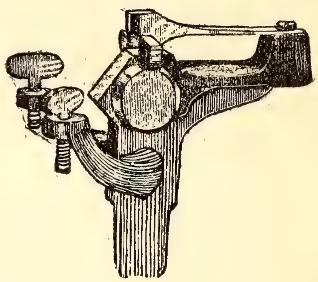


Fig. 5.

Sufficient has now been said on the subject of saws, in this journal, to enable the amateur to file his own saws tolerably well; but should he need further information he may obtain it from a work recently published by the proprietors of this journal, entitled "Hand-Saws, their Use and Abuse; How to Select and How to File." Price $1.00. I have drawn freely from the work in the foregoing papers.

Breguet.

IN days gone by, the clepsydra, the sun-dial and the hour-glass were used to record the flight of time. The clepsydra was a transparent case filled with liquid which slowly trickled through an aperture in the bottom, the receding waters marking the passage of the hours, which were indicated by characters traced upon the glass. This was the oldest and simplest form of the clepsydra; and the hour-glass was but a modification of the same principle, sand being substituted for water. The advantages of the hour-glass over

the clepsydra were two-fold: first, the sand would neither freeze nor evaporate; second, when the glass was full it would run little faster than when it was empty. The term "clock" originally signified "bell," and as the French use it to-day ('*cloche*'), still retains that meaning.

For several hundred years after their invention they were exceedingly rough and very irregular in their movements. To Galileo is due the discovery of the pendulum, which added greatly to the accuracy of time-keepers

One of the most celebrated clock-makers of the world was one Breguet, a native of Neuchatel, Switzerland. While yet very young, this remarkable individual was sent to Versailles for the purpose of learning his trade as a horologist. He there served a regular apprenticeship, and his advancement is said to have been most remarkable.

His parents being poor, it was necessary for him to rely upon his own energy for his advancement. This he did, and worked with a vim and enthusiasm beyond his years. He at last finished his apprenticeship, but not content with that, he worked three months over his time, without salary, to perfect himself in some of the branches in which he thought himself to be lacking. About the time he finished these three months, he lost his mother and father, and his eldest sister was left for him to support. He felt that the knowledge of mathematics was absolutely indispensable to attaining perfection in the art, and accordingly he found means to attend a course of public lectures which were given at the College Mazarin. The professor was struck with the unwearied assiduity of his young pupil, and they became fast friends, and this friendship contributed not a little to the progress of the student. Time and perseverance conquers everything, and the young clock-maker soon became a skilful workman, and in a short time an accomplished artist. A few years only, and the name of Breguet was celebrated throughout the globe.

The revolution of 1789 destroyed the first establishment of Breguet, and the great artist was obliged to seek an asylum on a foreign shore.

After an absence of two years, however, he returned to Paris and opened a new establishment, which flourished until his death, which occurred in 1823.

The following little anecdote will serve to prove the high esteem in which this artist was held even out of France. One day a watch, to whose construction Breguet had given his entire attention, happened to fall into the hands of one Arnold. Now Arnold was a celebrated English watchmaker, and he surveyed with admiration the simplicity of its mechanism and the perfection of the workmanship. He could scarcely be persuaded that a specimen thus executed could be the work of French industry. Yielding to the love of his art, he immediately set out for Paris without any other object than simply to become acquainted with the French artist. On arriving in Paris he went immediately to see Breguet, and soon these two men were acquainted with each other. They seem indeed to have formed a mutual friendship. In order that Breguet might give Arnold the highest token of his affection and esteem, he requested him to take his son with him to be taught his profession, and this was acceded to.

Breguet was member of the Institute, was clock-maker to the navy, and member of the bureau of Longitude. He was indeed the most celebrated clock-maker of the age. He had brought to perfection every branch of his art. Nothing could surpass the delicacy and ingenuity of his free escapement with a maintaining power. To him we owe another escapement known as the "natural," in which there is no spring, and oil is not needed; but another and still more perfect one, is the double escapement, where the precision of the contacts renders the use of oil equally unnecessary, and in which the waste of power in the pendulum is repaired at each vibration.

The sea-watches or chronometers of Breguet are famous throughout the world. It is well known that these watches are every moment subject to change of position from the rolling and

pitching of the vessel. Breguet conceived the bold thought of inclosing the whole mechanism of the escapement and the spring in a circular envelope, making a complete revolution every two minutes. The inequality of position is thus, as it were, equalized in that short space of time; the mechanism itself producing compensation, whether the chronometer is subjected to any continuous movement, or kept steady in an upright or an inclined position. Breguet did still more; he found means to preserve the regularity of his chronometers even in case of their getting any sudden shock or fall, and this he did by the parachute. Sir Thomas Brisbane put one of them to proof, carrying it about with him on horseback and on long journeys and voyages. In sixteen months the greatest daily loss was only a second and a half—that is, the 57,600th part of a daily revolution.

Such is the encouraging example of Breguet, who was at first only a workman; and to this he owes his being the best judge of good workmen, as he was the best friend to them. He sought out such everywhere, even in other countries; gave them the instruction of a master of the art, and treated them with the kindness of a father. They were indebted to him for their prosperity, and he owed to them the increase of fortune and fame. He well understood the advantages of a judicious division of labor, according to the several capacities of artisans. By this means he was able to meet the demand for pieces of his workmanship not less remarkable for elegance and beauty than for extreme accuracy. It may indeed be said that Breguet's efforts gave a character to French horology that it has never lost. So much may one man do in his day and generation to give an impetus to an important branch of national industry.

AERIAL NAVIGATION.—A discovery has been made in Paris of the twelve manuscript books on aerial navigation, by Leonardo da Vinci. The screw propeller is the system on which Leonardo made his experiments, and his sections and diagrams are all clear and neat.

Art at Home.—Artistic Household Adornments at Small Cost.

A VERY handsome ornament can be made of an unglazed terra cotta vase. This ware is porous, and hence it can be easily saturated by placing the vase in a bucket of water for twenty-four hours; then remove it and scatter over the surface small seeds, completely filling the interstices, from which there will shortly appear an interesting germination, forming a "living vase" that is remarkably ornamental. When the plants are developed, to prevent them from becoming detached take pack thread or fine wire and pass a row or two around the vase; the same will soon be concealed by the increased vegetation. Should the vase selected or preferred be a non-porous ware, cover it with a piece of cloth thoroughly wet and scatter over this the seed, the growth of which will be very prolific and exceedingly novel.

A pretty piece of industry for the warm weather may be found in utilizing a yard or two of "butcher's" linen. Fringe out the edges, and for a pretty heading draw out the threads to the width of an inch, hemstitch the same with French embroidery cotton; for the centre draw with a lead pencil a wreath of scroll work and trace over the lines with cotton a chain stitching, and where the curves are sharp do them in double chain stitch which gives a pretty change producing quite an ornamental pattern. When the article is finished it can be used in several ways if spread over the centre of a dark tablecloth. Where the gaslight or lamplight is reflected on the white linen, the effect is very novel. A set of covers for a bureau and washstand can be easily made of this same style of linen. Fringe out the ends to the depth of four inches, then knot a heading by taking ten threads in a cluster and tying the same at the top; over the tie, knot a coarse thread of French embroidery cotton, clipping the ends closely; dot the sides with the same kind of thread, which must be carried to the next dot without clipping, and in this manner a pretty network is traced with-

out any difficulty. Embroider in the centre some sort of Japanese design; the pattern selected should be as quaint as can be found, and executed in blue cotton if the dots are wrought in scarlet.

A unique shopping bag is made of common bed ticking, the blue stripes covered partially with gold thread (a good sized ball is sold for 18 cents); the effect is artistic; the blue tint just visible gives a charming subdued beauty to the gold work; the white stripes are adorned with point russe; stitch in embroidery silks of bright shades spanning the stripe at short intervals. The effect is very rich, showing off splendidly the color combinations; finish the top of the bag with silk or satin and adorn the corners with silk tassels or ribbon bows. The cost of these materials will not exceed $1.50, and a bag is made that will look far more artistic than one formed of cotton macrame lace. The linen macrame lace is very handsome, and when brought in combination with handsome ribbons and good silks the results of such artistic work is exceedingly satisfactory.

A wall pocket, formed of Japanese fans is quite an addition to a prettily furnished sleeping room. Arrange the fans one above the other, taking two for the base; shorten the handles of the other three fans, which should be tacked to a strip of stiff paper, covered with satin or brocade. Around the fans run a fluting of narrow lace, and adorn the handles with very narrow ribbons, Maypole style; cross the handles of the first or lower fans, and here place a cluster of buds or a brilliant butterfly with spread wings, and tack the pocket to the wall.

Oriental embroidery is very effective on plain Swiss muslin curtains. Select quaint patterns and finish off the edge with a ruffle of the same goods laid in fine knife plaits. Another pleasing style of curtain drapery is obtained in this manner: Take unbleached muslin, (that at six cents per yard is the best), cut the same into strips about four inches wide; purchase common lace insertion, and buy half an ounce of cochineal, put this into a quart of vinegar and water, and dye the insertion a rich pink. When combined with the cloth pieces a very attractive bedroom curtain is obtained at small cost and very little labor. Cheap unbleached muslin curtains are made to look very picturesque by drawing out the threads a space of two inches on the sides and at the lower edge; hemstitch the same with French cotton and trace with embroidery cotton at regular intervals over the rest of the drapery clustered leaves, and give to the outer edge a finish of pleated lace, which may be had for five cents a yard.

A collection of specimens of plants, carefully dried and preserved in a book manufactured for this purpose, forms an exceedingly interesting industry, and also gives an excellent opportunity for acquiring a knowledge of plants that might not be obtained unless engaged in forming a hortus siccus. In order to make this style of book interesting beyond the mere sight of the plants, a brief sketch of the same should be written on the opposite leaf. Some flowers are difficult to press, and especially when about half dried, the leaves break off or the stems crumble to pieces, and thus the plant is made useless; however, with care and particular attention this trouble can be obviated. When plants are gathered they should be at once arranged and laid between the leaves of an old book or in a newspaper; if the latter, then an old book cover or stiff pasteboard is required, into which lay the paper containing the plants, and place the whole beneath a weight. Leave it there for several days, then look at the work, and turn over the plants; should the paper be much stained remove it and lay the flowers in fresh paper. When sufficiently dry place in the blank book, classing them. A narrow bit of ribbon formed into a bow and glued to the stems clustered gives a bright finish to the page. When ferns are bleached they make an interesting decoration to the pages of a hortus siccus. The bleaching is done in this manner: To three quarts of water put six ounces of liquid chloride of lime and twelve ounces of sal soda. Lay the fern leaves into a basin of clear water, adding a small portion of the preparation from time to time until the leaves are nearly white: then

remove them with a bit of blotting paper and place them on a board (covered with a towel), and let them dry gradually by not exposing them to the full rays of the sun.

Spatter work is exceedingly interesting, and when neatly executed the result is particularly pleasing. Almost every kind of leaf can be used. Some prefer ferns to all others, and every kind of small flower may be used to advantage. Press the leaves for an hour or so before using. The process of spattering is simple, and may be executed by quite small girls. Place a piece of thick paper on a smooth board, tacking the same at the corners; lay on the leaves as required that is suiting special taste, and tack them down; then go over the paper with a brush saturated with India ink, or take a very fine comb and use this instead of the brush; when the paper is dark enough remove the leaves.

Portraiture for Amateurs.

THE taking of portraits in groups —even in a well-appointed studio, where the light is under full control and the most perfect of apparatus at command—is one of the most difficult phases of portrait photography, and one that taxes the skill of the operator to its fullest extent in order to obtain satisfactory likenesses, at the same time combined with an artistic picture.

After calling attention to this fact it will be manifest that one of the principal considerations in connection with outdoor portraiture—and one upon which much necessarily depends in obtaining satisfactory pictures—is the judicious selection of a situation for our operations. On this part of the question no definite instructions can, of course, be given, as all must of necessity be dependent upon the space available. However, we shall endeavor to give the student a few practical hints which may materially assist him in his selection, and, at the same time, help him to make the best of what circumstances have placed at his command.

First, let us consider our present requirements apart from the apparatus, as that portion of the question has been fully disposed of by abler authorities. A space is required where the sitters can be posed so that the sun does not shine directly upon them, and where the surroundings will form a good natural background. This is an important matter from a pictorial point of view; for what looks worse than to see a picture, otherwise good, spoiled by an unsightly background? Yet one often sees a group of figures posed before a plain, flat brick wall; and nothing uglier than this, in the eyes of an artist, can well be imagined as a background.

One thing to be specially guarded against, when it can possibly be avoided, is to include any portion of the sky in the picture, except, perhaps, when taking sunlit pictures. We also require sufficient space to allow of the camera being placed at such a distance from the group that the whole of the figures are included on the size of plate with which we are working. Furthermore, it is very desirable that the situation chosen be one in which the sun does not shine upon the lens; for, although the direct rays may be shielded from it during exposure, it will not be possible to obtain anything like so brilliant a negative as if it were shining in any other direction. If a veranda be available, it will, as a rule, form a very desirable spot for operations, as the main building with which it is connected will block out the sky, as well as tend to shield the lens from extraneous light. It will also afford us facilities for obtaining good *chiaroscuro*, as, generally, the supporting columns are covered with trailing plants of some kind, whose foliage casts shadows which may be utilized with advantage in the composition.

In posing a group under or about a veranda, care must be exercised that none of the figures are placed in deep shadow while others are in strong light, otherwise in the picture some of the faces will be dark—sometimes nearly black, while others are all that can be desired. This is very likely to occur if the roof be a low one and some of the figures are standing beneath it. When any of the figures are

arranged under a low veranda they should be sitting, or, if standing, brought well forward, so that the shadow cast from the roof or foliage does not fall upon any of the faces. This arrangement, if the central figures be under the veranda, will suit the requirements of the lenses admirably. When very fair and very dark persons have to be included in the same picture, the blondes may with advantage be posed somewhat under cover, whilst the brunettes are brought more into the open.

In composing the group, the figures should be arranged as much as possible in the middle of the plate, the principal figures occupying the most central position, as the centre should always be the most important part of the picture. A few plants or shrubs in pots, judiciously distributed, will form charming acccessories when the group is posed in the vicinity of a veranda. Some of the most successful outdoor groups we have ever seen were taken under or about a veranda that was charmingly covered with creeping plants.

A portico or porch affords a very admirable situation for posing a group, particularly when only a few figures have to be included, as some one or two may be arranged within and the others outside, taking care, as in the case of the veranda, that those which are posed within are in no way placed in direct shadow. This is best avoided by having those within seated and fairly well forward, so that they will be clear of the cast shadows from the roof and sides. Porticos are usually covered with foliage of one description or other, which is a great advantage for our present purpose. When the foliage happens to be ivy (which it frequently is) a very full exposure must always be given to the negative, otherwise the background will be exceedingly dark in the resulting picture, the foliage of ivy being of such a very non-actinic character; and, unless the sun be shining directly upon it so as to produce bright reflections from the leaves, it will always look unpleasantly heavy unless very fully exposed.

Very admirable groups may be secured with an open window as a background. Some of the figures may then be arranged within the room, while others are without on either side. If the window be a French window, opening to the ground, so much the better, as then the whole of the figures of those inside the room, whether standing or sitting, can be included in the composition. It is necessary, in arranging a group thus, to be careful that none of those figures which are outside shall be in such a position as to cast a shadow, at least, on the faces of those within. This arrangement, it will be seen, favors the lens, as the centre figures are situated at a greater distance from it than those at the sides.

When some of the sitters happen to be in very light dresses, it is always advisable to pose them in such a manner that the dress, or the major portion of it, is hidden or subdued. This is easily accomplished with the window background, by placing such sitters inside the room, or, in the case of either of the other situations, by arranging those in the light dresses somewhat behind the others, so that the dress is, for the most part, hidden by those in front, or a strong shadow from them is cast upon it.

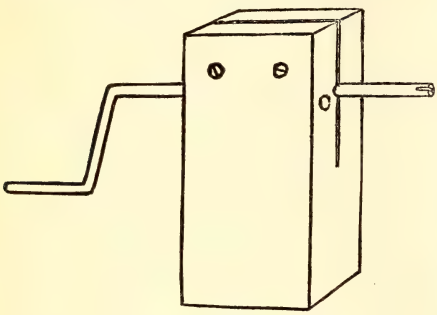
In taking a photograph where a window forms part of the background, care must be observed that no reflections from the glass is shown in it, otherwise it will cause the picture to look patchy. These reflections should be carefully looked for when focussing, and, if any be noticed, they can generally be avoided by slightly altering the position of the camera—placing it at a slightly different angle with regard to the reflecting surface.

In concluding this article, we cannot too strongly impress upon the student the necessity of observing, when the group is finally arranged, that all the faces are equally illumined, otherwise it will be impossible to secure equal density in the negative, which, if successful portraits be the chief consideration, is most essential.

— Out of all the myriad lights in the heavens, the Earth is visible only to the Moon, Mercury, Mars, and Venus.

A Tool for Winding Coiled Springs.

A CONVENIENT tool for winding coiled springs may be made as shown in the accompanying illustration. Procure a block of hard wood of any convenient size, say about four inches wide, about two inches thick and about eight inches long. Bore a hole through it near the upper end to



receive the cranked rod as shown. This rod may be of the size that the spring is to be made, or a little less in size, as the spring will open some after being wound. Saw a slot down through the centre of the block and the centre of the hole bored to receive the rod. Let this slot extend about half the length of the block. At the upper end put in two common wood screws, that do not quite reach through the wood. These screws, when turned in, will serve to keep the rod steady, especially if it be a little smaller than the hole; or, if one rod is of little less diameter than another. One end of the rod is bent in form of a crank as a means of turning it, and the other end has a small slot made in it to receive the end of the wire, and so hold it when beginning to form the coil. A small staple is driven into the block through which to pass the wire. To coil a spring, draw the rod back so that only the slotted end projects, pass the wire through the staple, and insert the end in the slot of the rod. Now turn steadily, and as the wire is wound it will draw the rod endwise through the block. This will form a close wound and even spring.

To make an open spring, two wires can be wound side by side, and the opening will be of the diameter of the wire. To make a greater or less opening, hold a hooked piece of iron on the rod, and let this come between the wire as it is wound on the rod. Its width will determine the opening of the coil.

To have larger or smaller springs, wire of greater or less size must be used, and different sized holes to receive these rods may be made in the same block. The length of the rod will govern the length of the spring, although when wound as long as the rod will permit, the spring can be pushed off, and the lost turn caught in the slot at the end of the rod, and another length made.

The block can be held in a vise, or it can be held to a bench or plank by means of screws put through the lower end.

Strange Weapons, and Stranger Ways of Using Them.

FROM the stick, stone, or club carried by many a savage hunter to the intricate and carefully-finished piece of mechanism which forms the equipment of the sportsman of civilized countries, is a very long stride, but between these two extremes are to be found a number of weapons and devices for capturing and destroying the various wild animals—or even man himself—which, as the invention frequently of beings who occupy a very low position in the human scale, cannot but raise a feeling of admiration and astonishment. It is of some of these I purpose to speak in the present article.

We will commence by a description of the hunting of horses by means of that terrible weapon of Central America, the lasso. Without the lasso, the Mexican owner of large herds of half-wild horses would find it utterly beyond his power to capture the members of his flock, either for the purposes of sale or of ridding them of the numerous insect pests which in many cases would make short work of the unfortunate animals whom they persecute with their attentions.

Let us see how the *vaquero* goes to work. Armed with his lasso—which is composed of three strips of raw leather, plaited, and is about forty feet in length—and mounted on a powerful horse, he follows the animal he has selected until he finds himself within a proper distance for throwing his weapon with the best effect. Seizing the iron ring which is attached to one end of the lasso with his left hand, he draws the lasso through it with his right, and, stretching out his arms so as

to make a noose of some six feet in length, he grasps the ring with his right hand, whirls the noose several times round his head and hurls it with unerring aim, seldom failing in placing it around the horse's neck. The noose immediately runs up tight, when a dexterous twist causes a coil of the lasso to encircle its nose, and the interruption of the respiration which ensues brings the horse to a dead halt. The *vaquero* then springs from his steed, carefully approaches the captured animal, bandages its eyes with his handkerchief, and speedily relieves it of the pests which would otherwise literally devour it.

Somewhat akin to the lasso is the bolas of the Indians of the Pampas, Patagonia, and other parts of the great American continent. This formidable weapon is composed of two thongs formed of several strands of raw hide, plaited together, and measuring from four or five to nine feet in length. At one extremity of each thong is a ball of stone, iron, or copper, as the case may be, the latter being the most valuable on account of its superior weight, and therefore the smaller size which the balls may be made, and the consequent greater handiness of the weapon. When stone is used, the bolas are about as large as a cricket-ball, and are fashioned with great care by the Indian women, the grinding of one stone to a circular shape making a good hard day's work. The balls are then placed in bags of leather, which have a number of holes round their mouths, into which the thongs are plaited and interlaced, the other ends being connected together by a short piece of raw hide. The Indian twists the bolas round his body in such a way that it can be immediately detached when opportunity occurs for its use. He then, with a preliminary whirl around his head, launches it at the mark, be it man or beast, and such is the dexterity with which it is thrown, that he can either cause it to slay outright by twisting round the neck of the victim and choking him or dashing out his brains with the heavy balls, or he can content himself with simply breaking a limb or merely twining the thongs around the body and causing the balls to fall in such a way as to hamper the movements of the swiftest animal, and give the hunter time to approach and secure it.

John Chinaman's method of taking ducks is a sample of the ingenuity and wiliness which form a staple part of the character of the "heathen Chinee." John sees a flock of ducks disporting themselves on the surface of the river, and, getting above stream, cautiously launches a gourd from the bank, which is soon carried into the midst of the feathered bipeds. Of course, a vast amount of quacking immediately ensues; but presently the ducks' suspicions are overcome, and they allow the successive gourds that John sends out to make their way amongst them with less and less comment. Now is John's opportunity, and, placing over his head a gourd, which he has carefully hollowed and provided with loopholes for looking through, he wades cautiously into the stream, and presently is in the midst of the feathered convoy, the whole of his body being concealed beneath the water. The ducks see nothing suspicious in the arrival of the new gourd, and one after one they are dragged beneath the water without a sound, and fastened to the girdle of our friend, who in this way reaps a splendid harvest.

The unfortunate duck is made the victim of another fraud in swampy fens. There, on the broad sheets of water which form the distinctive feature of these districts, the trapper builds a long tunnel of wicker-work, which is bedaubed with clay, half concealed with rushes, and made to look as innocent as possible. Then he sets afloat two or three carefully-trained decoy ducks, which, getting amongst the flock of wild ones, gradually lead them to the mouth of the tunnel. In this work the decoys are assisted by dogs trained to run along the banks, and, by their barking, frighten the wild birds, and drive them in the required direction. Led by the decoys, they are only too glad to take refuge in the innocent-looking tunnel, but at the other end the hunter is waiting for them, and, once within the mouth of the deceitful haven, they have passed far towards that bourne from which no duck returns.

Here is a plan adopted by the peasants on the French side of the Pyrenees for the capture of the flocks of birds of passage which at certain periods of the year pass through the country which they inhabit, and generally for taking all kinds of birds that fly in flocks in that part of Europe. it is customary for the inhabitants of the villages to combine together to erect a number of tripods, which rise to a height superior to that of any of the trees in the neighborhood, and on the top of each is placed a hunter, provided with a sort of kite in the shape of a sparrow-hawk. At some considerable distance from the tripods are a number of nets, suspended between the trees so as to form a vertical wall of net-work, rising to a height of thirty, forty, fifty, or sixty feet and upwards. Upon the ground, in a little hut is another hunter, lying at full length, and peering through a small hole left in the front of his shelter-place. As soon as a flock of birds is descried, it is allowed to get between the line of tripods and the nets, when first one hunter and then another launches

out from him his sparrow-hawk kite, which he draws back by the cord which retains it, launching it out again and again as occasion may require. At the same time the whole body of hunters raise a chorus of the most unearthly cries. Frightened by the din, and the sparrow-hawks floating over them, the flock of birds gradually descend lower and lower, until, by skilful manœuvring, they are made to alight just beneath the vertical nets. Now is the time for the gentleman in the shelter-hut. He lets go the cords which retain the nets in position, the nets fall forward upon the frightened birds, and, *voila tout!*

Of pigmy stature, and of perhaps the lowest grade of any of the races of humanity, possessing neither headmen nor chiefs, nor even proper names, the miserable Bushman or Bosjesman of South Africa is yet dreaded and avoided by the stalwart and warlike Kaffirs, Zulus, and Hottentots by whom he is surrounded. So much is this the case that these tribes submit in quietness to the loss of the greater part of their worldly goods in the shape of cattle and horses, which are constantly being stolen by their crafty little enemy, who can hide himself behind a stone or a few shreds of scanty herbage, or, if necessary, bury his yellow body in the sand, which in color it so nearly resembles, in order that he may escape detection and carry out his nefarious designs. Indeed, it is not until their patience is utterly exhausted by the numerous depredations to which they are subjected that a number of them will reluctantly combine together to root out their wily foes. And why is this ? No one who looks at that puny savage carrying a tiny little bow and a quiver of wretched, featherless arrows, never exceeding eighteen inches in length, and of about the thickness of a quill, the heads frequently composed of pieces of bone, and only occasionally of small triangular-shaped bits of that to him almost priceless metal—iron, would imagine that he possessed much power to harm any living being, much less the magnificent natives of the Cape and the adjacent country. But these same wretched little arrows are tipped with a subtle poison, which in almost all cases carries death with a scratch, and in some cases, according to the kind of poison used, causes the victim excruciating torture, speedily ending in the loss of reason and death. The little weapon is manufactured first of a reed, bound at one end by a piece of ligament from an ostrich, or some other animal; on the other end is placed a piece of bone, to give weight at the tip, and assist the arrow in its flight; and next comes the sharp triangle of bone or iron which is to form the barb, and which is placed loosely in its socket, so that when it has struck the mark the shaft of the arrow may be withdrawn, but the head will remain within the wound. Three kinds of poison are used, the first entirely vegetable, the next vegetable with which is mixed virus extracted from the poison-bag of the cobra, or some other venomous serpent, and the third consisting of the juice of a grub called n'gwa or k'aa, which latter kind causes the indescribable agony already referred to. It is a disputed point whether or not any antidote exists with regard to the first and third of these poisons, but in respect of the second the mixed nature of the venom renders the application of any remedy out of the question. Fortunately for his neighbors, the Bushman is but an indifferent marksman, and unless he can get within six or seven yards of his target anything smaller than a haystack is pretty certain to escape unhurt. The Bushman carries several of his arrows in his headdress. This is his invariable practice, so that he may always have some ready to hand, and such is the rapidity with which he can snatch them from their place and fit them to his bow that it is no uncommon feat for a Bushman to get off three shots within two seconds.

Now we come to what is perhaps the most remarkable of all weapons. Certainly it is the only one that possesses the power of returning to the hand of its owner after it has been thrown, providing always it has failed to hit the mark, and its flight has not been affected by coming into contact with any object. An Australian native is not overburdened with goods and chattels, and usually carries the whole of his worldly property with him. This consists of his loin cloth, with a cord spun from the fur of the opossum round his waist, in which is stuck at the back, his hatchet, the head of which comes exactly over and in a line with his spine. In the same cord, which is very elastic, are placed his boomerang, or kiley, and his dow-uk, a short heavy stick for flinging at the smaller animals. In his left hand he carries his throwing-stick and several spears, headed in two or three different ways, to answer the various requirements of war or of hunting. See him when engaged in the chase of the cockatoo, as he crawls noiselessly towards the edge of some broad lagoon, yet not so noiselessly but he rouses the suspicion of the sentinel cockatoos, who draw in to the main body of the flock, which is asleep on the branches of the trees which cover the banks. Presently the Australian springs to his feet as the birds take the alarm and circle in dense masses above the still water. Raising his right hand over the shoulder, he takes

one or two steps forward, and away flies the boomerang straight before him, but gradually nearing the surface of the lake, when just as it appears about to bury itself in the dark water, up it soars with inconceivable velocity into the midst of the startled cockatoos, striking right and left upwards and downwards, its wild gyrations rendered still more extravagant by the resistance of the birds which fall victims to its blows.

Another very remarkable weapon is that in use amongst several of the tribes of Guiana, notably the Macoushie Indians, who have the reputation of being the best makers of it. The wonderful blowpipe which varies in length from nine to eleven feet, and is formed out of a reed, which must be absolutely devoid of anything approaching the semblance of a knot, and the bore of which must not diminish appreciably throughout its entire length. Let the studious reader imagine what the complete reed must be like which fulfils these requirements. It is estimated that it must be at least 200 feet in length, and is probably an aquatic plant, the weight of which is supported by the water. Slender as the tube is, it would readily be broken were it not protected by an outer case, formed of the stem of a young palm-tree, from which the pith has been extracted, and in the centre of which the reed is cemented with kurumanni-wax with mathematical accuracy. A foresight with a dent in it similar to the backsight of the modern rifle is formed from a seed of the acuero, and the two upper incisor teeth of a small rodent called the acouchi, provide the backsight, which again bears some resemblance to the foresight of our best rifles. The projectile, which is made from the leaf ribs of a palm, is about nine inches in length, of the thickness of a knitting-needle, and is sharpened to the utmost degree. A pad of cotton is fastened at the feather end of this tiny arrow, which exactly fits the bore of the blow-tube. But the instrument is not yet complete. There remains to dip it in the deadly *wourali* poison—so deadly that should the Indian accidentally scratch himself with his venom-tipped dart, he immediately bids farewell to his friends and relatives, knowing that his hours, nay, his moments, are infallibly numbered. To provide against such a contingency he carries his darts in a peculiarly-shaped quiver, which, whilst it permits him to withdraw one arrow at a time, effectually prevents the points from coming into contact with his hand. The *moment* his quarry is struck the poison begins its work. The bird is unable even to lift its wings, and after nodding drowsily for a few moments, it falls dead at the Indian's feet. But for this rapid action of the poison the weapon would be of little avail, for in a country where vegetation is so dense, and grows with such amazing luxuriance and speed that a road which is made to-day cannot be found a fortnight hence, a flight of a very few yards would mean the almost certain loss of the animal in the tangled foliage. How the birds killed by so terrible a poison are made harmless food for man has not been explained by travellers.

Last, we come to a device which is used for the capture of that Ishmael amongst quardrupeds—the wolf. A strong stake is driven into the ground, and around it an enclosure is constructed, without any opening whatever. At the distance of from two to three feet from this is erected another enclosure, with a door in it opening inwards, and prevented from going too far back by a stout post driven into the ground. Each of the walls is of a sufficient height to prevent the wolf from leaping over it. To the stake a young lamb or kid is fastened, whose frightened bleatings soon fall like music on the ear of the ever hungry wolf. At once he makes his way to the enclosure, and, entering by the door, walks round, seeking an opening by which he can get at the young mutton so temptingly displayed a few inches beyond his very nose. Arriving at the gate which bars his further progress, he gives it a push. It fastens with a spring, and all that remains is for the hunter to quietly walk in, bind the wolf's jaws and legs, and congratulate himself on capturing one more despoiler of his flock. The securing of the wolf after he is in the enclosure is a task of no difficulty, for although he will fight to the death in the open, when he is cornered his courage entirely leaves him, and he may be bound without offering the least resistance.

Amateur Theatricals.

AS a hint, or series of hints to some of our readers who "indulge" in amateur theatrical exhibitions, we give the following experience which was obtained from before and behind the scenes:

"Passing through the folds of a remnant of old sailcloth I find myself in the corner of a large loft—partly covering a row of stables—stables unmistakably, from the occasional clamps of tired horses and the fragrant odor which proceeds therefrom—a little below the level of the foot-lights, and on the far side of the stage. There are no reserved seats whatever. From the raised platform to the outer walls are a number of rough planks ranged longitudinally, rising one above another as in an ordinary gallery. In the topmost corner on the right hand

is a small inclosure with a counter, devoted to the sale of "oranges, apples, and lemonade." The arrangements behind the curtain are primitive and simple; there are four tolerably well-painted scenes slung upon rollers, comprising an exterior, an interior, a wood, and a street. The brick-work at the back of the stage is colored to represent a landscape. Wings there are none; but the proscenium—three feet wide on each side—being fixed parallel with the seats, offers some slight protection to the actors in their entrances and exits. The musical element was sparsely represented; one instrument only—a violin—(an organ would have answered just as well) constituted the entire orchestra. Gas, of course, was unvailable, and candles were too insignificant; the boys, therefore, resorted to the use of a fearful compound of grease and oil, the fumes of which were suffocating. Five pans, in shape like huge garden saucers, were filled with this precious liquid and placed at intervals along the edge of the platform to do duty as "floats." Sometimes the business of the drama required a night effect; this was managed by means of a long slip of board fastened to the stage by hinges, but lying flat thereon, until the appearance of the blood-stained spectre or the pallid ghost called for darkness, when, by the aid of a cord attached to each end, it was raised, and the necessary result followed. It should be mentioned that there are three "houses" or performances nightly, each of which lasts about an hour. The reader is supposed to be present at the first of these, say at 7 o'clock. By this time the audience has increased in number, and of course, to be like boys, they must make a noise that is deafening. "Stop it, old scraper" or "Rosin your Bow." "Pull up the rag!" "Now, then, look alive!" etc. Before the curtain rises, however, it may be as well to mention a little peculiarity attaching to the dramas enacted here. To-night we are to have "The Highland Cateran;" to-morrow, perhaps, "The Outlaw," and the night following, "The Freebooter." Thus with variations—harping on the same old string—we at last arrive at "Rob Roy" which generally ends the series of performances."

— We cannot tell how much we love by how much we feel. The matter of feeling is purely a matter of a little more or a less nerve put into the fibre—a little more or a little less sensibility. There is no moral quality in the basic element which constitutes a test. The strength and depth and purity of love is the heroic test. How much will your bear? How much will you suffer? How much will you sacrifice.

Our Girl's Department.

This department is intended exclusively for "Our Girls," and we hope to make it both interesting and instructive, and to this end we ask our young lady readers to assist by contributions, suggestions, or illustrations. There are thousands of little things that can be, and have been, made and done by young ladies, pertaining to decorative art, needle-work, etc., etc., that would be gladly followed but for a want of knowledge on the subject, and we know of no more pleasing task for a lady than that of teaching her younger sisters that which they are anxious to learn, and which may prove of real benefit to them in the future, as well as being useful and interesting for the present. We trust we will have no difficulty in persuading those who have something nice to show or speak of, to make use of this department. Remember, it is open to all, and if you have anything worth knowing suitable for this column, send it along, and we will give it our best attention. Do not be afraid to write because you may fancy your composition is not perfect, or have other scruples of a similar kind. Do the best you can, and leave the rest to the editor of this department, and we are sure you will be pleased with your work.

IF anything affects your eye, you hasten to have it removed; but if your mind is disordered you postpone the term of cure for a year.—*Horace.*

— Comparison, more than reality, makes men happy, and can make them wretched.—*Feltham.*

— To what atrocities cannot that mind reach which is impelled by selfish avarice.—*Virgil.*

— Let friendship creep gently to a height; if it rush to it, it may soon run itself out of breath.—*Fuller.*

— Many are ambitious of saying grand things—that is, of being grandiloquent. Eloquence is speaking out, a quality few esteem and fewer aim at.—*Hare.*

— Religion gives part of its reward in hand, the present comfort of having done our duty; and for the rest, it offers us the best security that Heaven can give.—*Tillotson.*

— The lightsome countenance of a friend giveth such an inward decking to the house where it lodgeth, as proudest palaces have cause to envy the gilding.—*Sir Philip Sidney.*

— There is a thread in our thoughts as there is a pulse in our feelings—he who

can hold the one knows how to think, and he who can move the other knows how to feel.

— Open rebukes are for magistrates and courts of justice. Private rebukes are for friends, where all the witnesses of the offender's blushes are blind and deaf and dumb.—*Feltham.*

— People may make injuries worse by unreasonable conduct, by giving way to anger and satisfying that for the moment, instead of thinking what will be the effect in the future.—*George Eliot.*

— A good memory is the best monument. Others are subject to casualty or time, and we know that the pyramids themselves, rotting with age, have forgotten the names of their founders.—*Fuller.*

— To divert at any time a troublesome fancy, run to thy books. They presently fix thee to them, and drive the other out of thy thoughts. They always receive thee with the same kindness.—*Thomas Fuller.*

— What we call miracles and wonders of art are not so to Him who created them; for they were created by the natural movement of His own great soul. Statues, paintings, churches, poems, are but shadows of Himself.—*Longfellow.*

— I always fancy I can hear the wheels clicking in a calculator's brain. The power of dealing with numbers is a kind of "detached lever" arrangement, which may be put into a mighty poor watch.—*Holmes.*

— Socrates called beauty a short-lived tyranny; Plato, a privilege of nature; Theophrastus, a silent cheat; Theocritus, a delightful prejudice; Carneades, a solitary kingdom; Domitian said that nothing was more grateful; Aristotle affirmed that beauty was better than all the letters of recommendation in the world; Homer, that it was a glorious gift of nature; and Ovid, alluding to him, calls it a favor bestowed by the gods.—*From the Italian.*

— Very many ladies have a habit while traveling of gathering leaves, sprays, or single blossoms, small reminiscences of pleasant journeys, etc., and pressing them in a sketch-book or small portfolio, previous to their being taken home and prettily arranged in the long winter evenings, when they awaken pleasant or sad remembrances, as the case may be, of days long past. The dried flowers, leaves, grasses, moss, etc., should be arranged on pieces of cardboard cut the same size, either in different groups of flowers, or like a graceful frame around a small sketch, with a quotation from a favorite poet below, in this case the single flowers must be gummed on with rather a thick liquid gum, which of course requires great care. If kept in a case on purpose, the collection will soon form a pretty album.

In passin' thro' this warld o' cares,
  Hoo aften dae we feel
Sad an' forlorn 'neath Fortune's scorn;
  E'en Reason seems to reel.
Yet we su'd ever bear in mind
  That He wha dis nae wrang,
Has made a law that ane an' a
  Maun creep afore they gang.
    Sae creep afore ye gang.
    Jist creep afore ye gang.
An' dinna let yer heid hing doun
  Tho' griefs the bosom thrang;
For bit by bit ye'll yet come roun',
  Then creep afore ye gang.

We've a' oor sorrows mair or less
  Oor lifetime tae endure,
But oh, how hard it is for some
  A leevin' tae secure;
Yet mony rise tae eminence
  Who sat in sorrow lang,
An' sae may we, gin we've the sense
  Tae creep afore we gang.
    Sae creep afore ye gang,
    Jist creep afore ye gang,
Ye canna thraw what's been decreed
  E'er man tae being sprang;
An' will be till the end indeed,
  Tae creep afore ye gang.

—*John Adam.*

— Pocket-handkerchief flirting has gone entirely out of the fashion, at least so say the girls. Parasol flirtation is the latest accomplishment in the art. The covered and figured heads are symbolic,

a plain crook meaning honesty of intention, a swan's head coyness, a crutch sympathetic, a hound devotion, and so on. The parasol carried plump overhead means keep away, as it is necessary to look about. Slightly on one side flashes the intelligence that the approach must be deferred. Thrown over the back conveys the intimation that the coast is clear. Carried way forward intimates that discretion must be exercised. Swinging round in the hand is a danger signal, meaning go away as quickly as possible. Held close down over the head means secresy. There is no significance in color, as this, if not a matter of taste, is regulated by the dress.

— A lively old lady who died far advanced in her eighties, and was proud in extreme old age of her beautiful dark hair, was accustomed, when a girl, to hang up her night-cap every morning filled with salt. This was shaken up into a japanned dressing box every night on retiring, but enough salt remained clinging to the cambric to secure, as she thought, the remarkable preservation of her hair. Dr. Holmes has sung or gossiped about the "widening part," which is one of the tell-tale tracks of passing years; but until lately the prevailing fashions of dressing the hair did not make any parting to show. Those who wear the hair in true classic style, with the pure white line from brow to crown, may find some use in the following recommendation of the New York *Evening Post* for strengthening the hair and renewing thin spots: "To a quart of warm water allow one tablespoonful of salt, and just before retiring for the night wet the head thoroughly with this, not along the widening seam alone, but the entire head. Repeat this operation for one or two nights each week until good effects are apparent." It is likely that the vigorous rubbing which this treatment makes necessary afterward is of as much use to the hair as the saline treatment.

— "Women," said a successful woman jeweller, "can do anything and everything nowadays. When I first had to earn my living I thought myself fortunate when I secured a place behind a milliner's counter. Well, I sold bonnets for a year, and the store was closed. Then I painted furniture, if you will believe it. It wasn't hard to learn, and I earned twelve dollars a week instead of seven. But I soon quit that for better employment, and was hired in a jewelry establishment. There I learned the trade, and I am as independent as you are." Miss Dora Kinney, of Wild Cat, Ind., is the boss shepherdess of the Wabash. A few years ago an uncle gave her an orphaned lamb to raise, by hand, which she did successfully, and becoming so much interested in sheep husbandry, she procured a mate for the lamb, and she now sports a fold of twenty-eight old sheep and thirty-three lambs—sixty-one in all, all from the first starting pair. Miss Kinney attends to her flocks altogether herself, both winter and summer, and now receives quite a handsome little income from the annual sales of wool and mutton. New occupations for women are yearly springing into being. The latest things I've heard of are landscape gardening, bird-fanciers, architects, junk-dealers, and pawn-brokers. Women do all these things now. Indeed, I'm afraid a bad time is coming. Women do so many kinds of work that the men will all become dudes. The fine, idle creatures these days certainly are not women.

BEAUTY.—II.

Diana of Poictiers, Duchess of Valentinois, was the reigning beauty at the courts of three successive kings of France. The historian Brautome says, "I saw this noble dame when she was about seventy years of age, and she was as charming, as fresh, and as lovely as any lady of thirty. Her beauty, grace and majesty were such as she had ever possessed. It was said that certain skilled doctors prepared for her daily a potion of soluble gold, and that this, or some valuable drug, preserved her beauty." It was not soluble gold, or valuable drugs, but a daily bath in rain water.

Mary Stuart and Margaret of Anjou, in

early times, were as wise as serpents in the magic of the toilet, disdaining neither May dew or other simple beautifiers.

Sea bathing is now so fashionable in summer, that it must be spoken of in a cosmetic point of view. It is an admirable tonic to the general system, and increases the circulation to a marked degree. Thus it often improves the looks. But as an author of reputation remarks, "As an agent for preserving the softness and delicacy of the healthy skin, and the bright hues of the complexion, it is inferior to the tepid bath." Those who live by the sea are often robust and comely, but rarely have fine skins.

The noble dames of ancient Rome, who have never been surpassed in luxury, were wont to plaster their faces at night with a poultice of bread crumbs and asses milk, which, on being removed in the morning, left a freshness and whiteness very much prized in their day. They also bathed in fresh milk, which was rather an expensive luxury.

Erasmus Wilson is said to have been the first to propose sulphur lotions for eruptions of the skin. The usual lotion of the flowers of sulphur, with glycerine water, is a valuable remedy, but from the readiness with which the sulphur separates, is inconvenient, and is not quite satisfactory in its results. A far more efficacious mode of using sulphur, is to dust it on the face every night with an ordinary puff used for toilet purposes; recently, however, cases of acne of two years' standing, which had resisted the ordinary methods of treatment, yielded at once to sulphur thus applied. If the sulphur be scented with oil of lemon or roses, it will form an elegant cosmetic. Sunburn is a redness which remains on the skin after exposure to great heat. The skin sometimes peels off, and the surface is hot, inflamed, and tender. It may be produced by the sun, or by sitting too near a hot fire. Those who cherish a delicate complexion should never sit too near the fire. When the sunburn is only occasional, it can readily be removed by the following formula. It may be applied at night after washing the skin, and be allowed to remain till morning. It not only lessens the redness, but soothes and allays the burning, dry, and irritated feeling: Spermaceti, 2 ounces; oil of almond, 2 ounces; honey, one teaspoonful. Melt the spermaceti, then add the oil of almonds; when they are thoroughly mixed stir in the honey. Take the mixture off the fire, and stir until cold. Some persons burn red much easier than others, and it is popularly regarded as a sign of health. The same difference in individuals is observable in tan. This is a brown discoloration rapidly produced on some skins by the solar rays. Here, as elsewhere, the dark hue is owing to a minute layer of carbon, which is deposited on the under surface of the skin. There are many recipes for removing tan. Washing the skin in buttermilk is a domestic suggestion. Lemon juice is also good. The solutions of corrosive sublimate, and other poisonous drugs, used by some ladies, are altogther too dangerous, and should be only prescribed by a physician. Many a fine skin is spoiled by freckles. Some have them only in the spring of the year. The exposure to the winds of March and its vernal sun, bringing them out in full force. Others have them all the year. Nearly all the means proposed in books are powerful caustics, which destroy the scarf-skin. A simple, harmless, and generally successful wash, is a saturated solution of borax in rose-water. It should be applied five or six times a day, and allowed to dry upon the skin. The following is considered good, and can be readily made: Best English mustard, a tablespoonful; oil of almonds, a teaspoonful; lemon juice enough to make a paste. Mix them well and apply, spread in a thick plaster, night and morning, until the skin smarts. After a few days, the scarf-skin will, or should loosen, and the freckles disappear. After they have gone the surface should be washed with borax and water several times a day. A delicate and effective preparation for rough skins, eruptive diseases, cuts, or ulcers is a mixture of one ounce of glycerine, half an ounce of rosemary-water, and twenty drops of carbolic acid. It is excellent for hives or prickly heat, quickly giving relief. The

carbolic acid neutralizes the poison of the blood, purifies and disinfects the eruption, and heals it rapidly.

The brown spots called moles are usually brought with us from birth. In former ages, when on the face, they could readily be concealed by patches, or what are sometimes called "beauty spots;" but those patches not being in vogue now, they must go unadorned or be removed. Dr. L. Thomas, in the British Medical Record, advises the use of "acid nitrate of mercury" for the removal of moles from the face. No pain attends the application, if care be taken to prevent touching the surrounding skin. The growth gradually shrivels away. The slough falls off in about a week, leaving a faint depression like a small-pox mark. The following is a recipe for a wash for the same purpose: Dried tops of rosemary, 4 ounces; dried leaves of sage, 4 ounces; dried flowers of lavender, 4 ounces; cloves, ½ ounce; Camphor, 1-16 ounce; distilled vinegar, 6 pints. Macerate fourteen days with heat, filter and bottle. Apply a drop twice a day to the moles, until they disappear. You can, of course, make a half or quarter of this quantity.

There is a black and greasy compound used by hunters and others who live much in the woods. It is generally used by them to keep black flies and mosquitoes away; but it has greater efficacy in whitening, softening, and refining the skin. It is also excellent for driving wrinkles away that come before their time. It is composed of tar and olive oil. Mix one spoonful of the best tar in a pint of pure olive oil; heat the two in a tin cup set in boiling water; stir until completely smooth. Rub this on the face when going to bed, and lay patches of soft cotton or linen on the cheeks and forehead to keep the tar from rubbing off. I might have been more concise and said, transform yourself into an amateur negro minstrel every night and go to bed.

A wash much used by the Spanish ladies to give firmness to a loose skin, and preventing wrinkles, is made with the whites of four eggs boiled in rose-water, to which is added half an ounce of alum and a little oil of sweet almonds. The whole beaten to a paste.

Milk of roses, or tincture of benzoin (the recipe I have given in a former number) was much used by the ladies during the time of Charles the II. for obliterating wrinkles. It is still used with success by many ladies of our day.

A little jar or glass of oatmeal is often seen on the dressing table of young girls. The meal is used in the place of soap. It contains a small amount of oil, and the friction against the skin brings the blood to the surface.

There are many washes and enamels for destroying and banishing wrinkles, but I think wrinkles are preferable to them, as they give the face a very artificial appearance, suggesting to the observer common rouge and chalk, or flour. Lady Paget says, with truth, "If women would only allow common sense to govern them, they would feel that for the inch or two they diminish the circumference of their waists by tight lacing, they become unattractive in many other ways; quite leaving on one side the hygienic part of the question, which, alas! the vain and foolish will never consider." There are few, indeed, who, like the clever and beautiful Marechale de Saubise, Louis XIV.'s faithful friend, will make the sacrifice of giving up all meat except chicken, and never wearing their stays for fear of injuring their health or complexion. Another absurd practice is that of wearing the skirts so tight and heavy that walking becomes an agony; there is no doubt that many have been debarred from healthful exercise for years. Much harm has also been done by the profuse use of perfumes, of which musk, patchouli, jessamine, and such like form the basis. These ingredients are depressing to the nervous system, acting upon it as poisons, just as they would if given inwardly, and at the right time, prove the most powerful medicines. The suggestion of the perfumer's shop is a poetic one, and the faintest suspicion of violets, lavender, or

> "The new mown hay
> Gives a sweet and wholesome odor,"

sufficient for the purposes of the toilet.

(To be continued.) M. W.

THE

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EDITORS.

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It is sometimes quite easy to appear good natured, but it is no test of amiability to appear good natured in the few and rare moments of serenity when all human troubles seem to have subsided. It is the boy and girl, who, when troubled, can preserve a calm and cheerful exterior to cheer those around them, who when oppressed by cares, have encouraging words for those around them, who, when disappointed or crossed themselves, have yet the disposition to point out to others the coming brightness and joy, and who give hope to others by their own cheerfulness. Such qualities as these make amiability; and the happy possessor is richer than though the mines of Golconda were his or hers.

The eleventh annual regatta of the National Association took place at Newark, N. J., on the 7th of August. The Passaic River was in fine condition for the racing, being as smooth as a piece of plate glass. The course was a mile and a half straight away, starting from the Midland bridge and ending in front of the grand stand, where a number of cylinders representing the color of the contestants were hoisted and lowered in accordance with their relative positions in the race, as telegraphed from stations set at every half mile on the course.

Some very good work was shown, the course having been traversed by junior single scullers in 8.52½, and by senior scullers in 9.00½.

In the senior four-oared shells one race was won by the Eureka Club, of Newark, N. J., in 8.06½. This showing speaks well for the rowing abilities of our amateur boatmen.

The spring and half of the midsummer cricket season of the metropolis have passed, and the record of the game compared with those of previous years shows that a larger number of clubs have played than ever before, and that there has been a great increase of cricketers in this section. The season was opened on May 14th by the Manhattans, on their grounds at Prospect Park, with a match with the Patersonians, and again, as in late years, the former club has outranked all its brother organizations in the number of games played. Second on the list as match players come the Staten Islanders, they being by far the strongest and most successful exponents of the game outside of Philadelphia. Then in order the Brooklyn, New York, St. George's, and Newark clubs have been seen in the fields.

We are pleased to notice the increased interest taken in the game of cricket, and that improved play has made a decided advance in both batting and bowling, noticeably the former, but as a rule fielding seems to be the stumbling block in all the different grades of matches. At times it is sharp and even brilliant, but then again it is almost sure to deteriorate into first prize "muffing." The attendance at the most prominent games has also been much larger than during last year, and this is especially the case when Philadelphia's crack elevens honor New York or other cities with visits, which, unfortunately, are seldom and far between. Now, as such matches are always certain of drawing a large assemblage, it seems strange that the secretaries of the clubs have not ere this arranged to play a series of games each year between

teams representing New York and Philadelphia and interstate matches during the month of September. Before the war it was a common thing to see the States of New York and Massachusetts, or New Jersey and Pennsylvania measuring bats, and a series of interstate contests at this particular time would do more to popularize cricket than any other series of games that could be thought of.

When boys—or girls either, for that matter—undertake to make or do anything that requires skill or thought, they should "make haste slowly," by doing it systematically, coolly, and deliberately. If amateur work is undertaken methodically, and free from excitement or undue eagerness, it is surprising how much more may be done, and how much better done it is. And then there is no unnecessary wear and tear of strength, no lost effort, and everything is more likely to go along smoothly. While at work, all the faculties should be concentrated upon it, for it is impossible to do good work while the hands are performing one service and the mind another. It was a shrewd observation of Kirke White, the gifted poet, whose early death adds a touch of melancholy to all he wrote, that he found, if he concentrated his whole attention on the dryest book he had to study, it soon became interesting, and in a short time he would become so absorbed as to turn over page after page unconsciously to himself. Intensity of thought is not exhausting if not too long continued; so that in one sense he who works the hardest accomplishes his task more easily. He has also much more time for rest and recreation. When at work, there should be as little interruption as possible, as these are apt to divert the mind into channels not related to the work in hand. Whatever may be the character of the work in hand—scientific, artistic, or mechanical—the surroundings should be as cheerful as possible, and with these conditions, if the worker is self-possessed and cheerful by nature, the work, no matter how hard it may be, will appear to be easy and pleasant.

Our Book Table.

A Dictionary of Useful Animals and their Products. A Manual of Ready Reference for all those which are Commercially Important, and others which man has utilized, including also a Glossary of Trade and Technical Terms connected therewith. By P. L. Simmonds. E. & F. N. Spon, Publishers. New York and London.

To students, and those interested commercially in fabrics, and other goods made from animal products, this little book will prove very useful, as it contains a great deal of information relative to these matters. Being a dictionary, the subjects are alphabetically arranged, and are easily found. So that the reader may have an idea of the work, we quote an item or two:

"Bear (*Ursus*), a well-known animal, of which there are several species. It is hunted chiefly for its skin, which is used for sleigh robes and wrappers, saddle housings and rugs. From 8,000 to 10,000 are received annually in England, but in the early part of this century nearly three times that number were imported. The flesh of nearly all bears is edible, but some is not very palatable. The long claws of the grisly bear are strung as necklaces, and highly prized as trophies of prowess among the Indian braves, who pride themselves excessively upon the number of bears they have succeeded in destroying."

"Moonga, or Mooga Silkworm (*Antherœa assama*, Helfer). The cocoons are soft and of a light fawn color. They furnish an excellent raw silk, of which there is a large consumption in British India. This silk forms one of the principal exports of Assam, and leaves the country generally in the shape of thread."

The book is well printed, and neatly and strongly bound.

Practical Carpentry. Being a guide to the correct working and laying out of all kinds of Carpenters' and Joiners' work. With the solutions of the various problems in Hip-Roofs, Gothic Work, Centering, Splayed Work, Joints and Jointing, Hinging, Dovetailing, Mitering, Timber Splicing, Hopper Work, Skylights, Raking Mouldings, Circular Work, etc., to which is prefixed a thorough treatise on "Carpenter's Geometry." By the author of "The Steel Square and Its Uses," "The Builder's Guide and Estimator's Price Book," "The Slide Rule and How to Use It," etc., etc.

This is the most complete book of the kind ever published. It is thorough, practical and reliable, and at the same time is written in a style so plain that any workman or apprentice can easily understand it, and for those of our readers who are fond of working in wood, it offers many hints and suggestions of a kind that every successful amateur *must* know. The work is published by the Industrial Publication Co., 294 Broadway, New York, and is sold at a price (one dollar) that places it within the reach of every one. It is illustrated by over 300 engravings, well printed on fine paper, and bound in a durable manner.

Hand Saws; Their Use, Care and Abuse. How to Select and How to File Them. By the author of "The Steel Square and Its Uses," "The Builder's Guide and Estimator's Price Book," "Practical Carpentry," etc., etc. Industrial Publication Co., 294 Broadway, New York. Price, in cloth, $1.00.

"Being a complete guide for selecting, using and filing all kinds of Hand Saws, Back Saws, Compass and Key-hole Saws, Web, Hack and Butcher's Saws; showing the Shapes, Forms, Angles, Pitches and Sizes of Saw Teeth suitable for all kinds of Saws, and for all kinds of Wood, Bone, Ivory and Metal; together with hints and suggestions on the choice of Files, Saw Sets, Filing Clamps and other matters pertaining to the care and management of all classes of hand and other small saws."

The foregoing, which is taken from the title page of the book, gives an idea of the scope of the work, and as the book is a thoroughly practical one, written by a practical man, it will be found useful and reliable for those who may have occasion to use saws of any kind. We heartily recommend this book to our amateur woodworkers.

Astronomy for Amateurs.—September.

BY BERLIN H. WRIGHT.

THE PLANETS.—SEPTEMBER, 1883.

(All Computations are for the Latitude and Meridian of New York City.)

Mercury may be seen as an evening star September 5th to 12th, being at greatest eastern elongation (26° 49′) September 11th, and brightest from the 8th to 11th. He sets as follows:

September	5th—7 14	evening.
"	8th—7 8	"
"	12th—6 59	"

He will be very close to the brilliant star *Alpha Virginis* (*Spica*), being only about two degrees west of or below that star.

Venus will scarcely be visible in September, being in conjunction with the Sun on the 20th.

Mars rises at midnight on the 10th, and on the 30th at 11.43 eve., and is moving eastward past the stars of the constellation Gemini.

Jupiter rises as follows:

September	10th—1 24	morning.
"	20th—0 54	"
"	30th—0 22	"

Inasmuch as it takes Jupiter an entire year to traverse a constellation or sign, his position will vary but slightly from month to month.

Saturn is now favorably situated for evening observation, rising as follows:

September	10th—10 1	evening.
"	20th— 9 22	"
"	30th— 8 42	"

He will be 90° west of the Sun on the 2d, and only one degree north of the Moon on the 21st, at 9 o'clock in the evening. Stationary, Sept. 22.

Uranus being in conjunction with the Sun on the 16th, will be invisible during this month and next.

SEPTEMBER METEORS.

The group radiating from near Algol, that from near Algenib, and that from the left of Cassiopeia's Chair will continue throughout September. A swift and brilliant group seems to radiate from a point about 10° north of Deneb, the bright star at the head of the Great Cross in the Swan; another from a point about 8° northeast of Capella, about the middle of the month. The earth enters a fine group about Sept. 25th, having a radiant about 10° south of Castor, in Gemini. This group is most active in October. A very swift and infrequent group visible in September and October, has its radiant about 20° east of Capella.

SITUATION OF THE PRINCIPAL CONSTELLATIONS, STARS, AND CLUSTERS, SEPT. 20TH, 1883, AT 9 P.M.

In the Zodiac, Capricornus crosses the Meridian, and to the right or west the constellations, etc., in their order are Saggittarius, the Archer, in which is the "Milkmaid's Dipper," Scorpio, the Scorpion, in which are many very conspicuous stars, and the first magnitude star Antares is setting.

North of the Ecliptic and west of the Meridian, the most conspicuous objects are quite near together and close to the Meridian, being the Great Cross in the Swan, which is almost directly overhead; to the right of it lies the Harp and Vega. And below it to the southward is Altair in the Eagle, and Job's Coffin; away in the northwest lies the Northern Crown and the great naked-eye nebula in Hercules.

Upon the east side of the Meridian the Zodiacal constellations are in their order from W. to E.; the eastern part of Capricornus, Aquarius, marked by the ⅄; Pisces, marked by the almost entire absence of stars brighter than the 5th magnitude. Aries and the Pleiades have but just cleared the horizon, and Taurus and the Hyades are just rising. The only bright star south of the Ecliptic is Fomalhaut, nearly two hours east of the Meridian and close to the horizon. Above the Ecliptic the first objects to catch the eye are the Great Square in Pegasus and Cassiopeia's Chair.

In the circumpolar district the Great Bear and Dipper are low in the north, almost touching the horizon; the wonderful cluster in Perseus and Cassiopeia's Chair to the right, and the Little Bear and Dipper and Serpent to the left of Polaris.

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS, SEPT. 21ST, 1883.

	H.	M.	
Alpha Andromeda (Alpheratz) in meridian	0	3	mor.
Omicron Ceti (Mira) variable, in meridian	2	14	"
Beta Persei (Algol) variable, in meridian	3	1	"
Eta Tauri (Alcyone or Light of Pleiades) rises	8	9	eve.
Alpha Tauri (Aldebaran) rises	9	28	"
Alpha Aurigæ (Capella) "	6	56	"
Beta Orionis (Rigel) "	11	35	"
Alpha Orionis (Betelguese) rises	11	11	"
Alpha Canis Majoris (Sirius or Dog Star) rises	1	40	mor.
Alpha Canis Minoris (Procyon) rises	1	15	"
Alpha Leonis (Regulus) rises	3	18	"
Alpha Virginis (Spica) sets	6	44	eve.
Alpha Bootis (Arcturus) sets	9	20	"
Alpha Scorpionis (Antares) sets	8	40	"
Alpha Lyrae (Vega) in meridian	6	31	"
Alpha Aquillae (Altair) "	7	43	"
Alpha Cygni (Deneb) "	8	35	"
Alpha Pisces Australis (Fomalhaut) in meridian	10	48	"

Penn Yan, Yates Co., N. Y.

A New Variety of Glass.

The *Wiener Gewerbe-Zeitung* states that a chemist of Vienna has invented a new kind of glass, which contains no silex, potash, soda lime, or borax. In appearance it is equal to the common crystal, but more brilliant; it is perfectly transparent, white, and clear, and can be cut and polished. It is completely insoluble in water, and is not attacked by fluoric acid, but it can be corroded by hydrochloric acid and nitric acid. When in a state of fusion it adheres to iron, bronze, and zinc.

Curious Fact Concerning Boiling Water.

At a recent meeting of a scientific association it was related that a kettle filled with boiling water was hung in the hottest room of some Turkish baths, with the lid on. The temperature of the surrounding air was 262° Fah. After about an hour the temperature of the water was taken, and indicated, as was expected, 212°. The kettle was then rehung with the lid off. The temperature of the room was now 252°. In twenty minutes the temperature of the water had fallen to 185°; in thirty minutes to 178°; in forty-five minutes to 170°, and was evidently still falling. The manager stated that it generally fell finally to about 140°, when a point of equilibrium seemed to be established, and the water neither got hotter or cooler. Mr. Haddock supposes this loss of heat was due to rapid vaporization and conversion of the sensible heat of the water into the latent heat of steam, and as dry air is a very bad conductor of heat (one of the worst known), the heat required to convert a portion of the water into steam had to be abstracted from the remainder of the water, thus lowering its temperature. In substantiation of this explanation, we believe that if water is placed in a vessel over a large bulk of strong sulphuric acid, in the receiver of an air pump, and the air is exhausted, the rapid evaporation of one portion of the water will actually cause the rest to freeze.

Hardness of Ancient Bronzes.

Ludwig has made a number of analyses of ancient bronze implements, of great hardness, with the following results:—

	Copper.	Tin.	Nickel.	Iron.	Phosporus.
(1.)	87·25	13·08	0·38	trace.	0·250
(2.)	83·65	15·99	0·63	"	0·540
(3.)	85·05	14·38	trace	"	0·106
(4.)	88·06	11·76	"	"	0·027

Specimen No. 1 was a fragment of an axe from Maiersdorf. The metal was tenacious, and bright yellow; hardness equal to that of apatite (5). No. 2, an axe from Linburg; reddish golden-yellow; tenacious, and hardly scratched by feldspar (6). No. 3, fragment of a sword from Steier; the metal was reddish-yellow, solid and tenacious, and not easily scratched by quartz (7). No. 4, a chisel from Peschiera; deep yellow, and containing a trace of cobalt; hardness, 5. Neither zinc nor lead was found in any of the specimens, though the latter metal is invariably present in ancient British implements.

Electric Light in China.

The introduction of western improvements into China by Europeans is evidently a work beset with many difficulties. Some years ago the only railway in the country was purchased by the Government from the proprietors and promptly torn up; but now the officials themselves are laying down railroads from the mines in North China to the nearest canal. The telegraph also had to encounter a vigorous opposition from the authorities and people for many years. At present, however, the capital is connected by wire with the coast. The electric light is the latest improvement which has excited the suspicion and dislike of the mandarins. The foreign settlement at Shanghai has for some time been lighted on the Brush system, apparently much to the comfort and jubilation of the denizens of the "model settle-

ment," as the foreign part of the city is generally called. The promotors appear, however, to have reckoned without the Chinese officials. They probably thought that where gas was permitted there could be no objection to electricity. The Chinese governor of the district appears to be of a different opinion. He has addressed a letter to the senior Foreign Consul, requesting the removal of all the electric lamps. He has read, he says, in translations from European papers, that terrible accidents have arisen from electricity, and flatly refuses to permit the residents of Shanghai to be exposed to such dreadful risks. Hundreds of thousands of houses might be destroyed, millions of lives might be lost, even the walls of the city might be blown down if anything went wrong with the machines. He has stictly forbidden his own countrymen to use it, and has peremptorily ordered those who have already adopted it to discontinue it forthwith.

Useful Trees.

In setting out trees along the roadside too little regard is had to use. The trees that are only beautiful become in time too expensive luxuries, as they take up room which cannot profitably be spared. Some trees are valuable for bee forage, as soft maple, bass wood and locust. The latter is also a valuable timber tree, and of late years the locust borer rarely troubles it.

Shaping young trees may be easily effected if taken in time, by summer pruning and pinching. A needless or misplaced shoot, which might become a conspicuous distortion if left to grow, is rubbed off with the thumb when an inch or two long. Branches which are running out too long are stopped by pinching off the ends. By these means a handsome and symmetrical head is easily given to a young tree, if taken in time.

The Spanish Marriage Stone.

If Ireland has its Blarney Stone, which assures to any one kissing it uncommon eloquence and persuasiveness—"blarney," in fact, for there is no other equivalent for the mysterious gift—Spain has her "marriage stone," the virtues of which are equally remarkable; for any single person, male or female, who touches it, is absolutely sure to be married within a twelvemonth. The stone forms part of the masonry of the college of Sacra Monte, in Granada. About twelve months ago, two young ladies paid a visit to the old Moorish capital, and were shown over the college by one of the resident clergy, who acted as cicerone, and who treated the fair visitors with unusual deference and respect. When they came to the "marriage stone" the padre smilingly explained the peculiar powers with which popular superstition credited it. "Touch it," said one of the ladies to her sister, who laughed incredulously, but followed the advice none the less—touching the stone, not once, but twice or thrice. Now, the two young ladies were the Spanish Infantas, Dona Isabella and Dona Paz; and the latter it was who touched the stone. She did so on the 3rd of April last year, and she was married to Prince Louis, of Bavaria, on the 2nd of April of the present year.

The Girl on a Tricycle.

The girl on a tricycle has already made her appearance at the summer resorts. As observed at Newport she sat between the two wheels, which were connected by a short axletree, on a kind of saddle—astride of it, but not so circumstanced as to make divided garments necessary, as in riding horseback, man-fashion. Her feet reached down to the treadles, and her hands were employed in steering by means of a device connected with a low front wheel. Her posture was not that of sitting, however, but her figure was suspended nearly perpendicular, and her legs were moved a great deal like those of a horse afflicted with springhalt or a swimmer treading water. Her knees came up high, with an action more productive of good exercise than of grace. And yet she was "a symmetrical and pleasing traveller." The prescribed costume is soft, thin flannel, with a blouse waist and a skirt reaching just to the gaiter tops. It is obvious that the latter level could not be steadily maintained, in view of the high treading required to work the tricycle, without some special modification of the garment. This want has been supplied by taking an idea from the equestrian habit. Lengthwise of the skirt in front two gussets are set in at points where the knees will protrude into them in rising.

Incombustible Paper and Inks.

Asbestos of the best quality is treated with potassium permanganate, and then with sulphuric acid; 95 per cent. of such asbestos is mixed with 5 per cent. of wood pulp in water containing borax and glue. A fire-proof ink is made of platinous chloride and oil of lavender, mixed, for writing, with Indian ink and gum, and for printing with lampblack and varnish.

Scientific News.

—The thirty-second meeting of the American Association for the Advancement of Science was held at Minneapolis, Minn., beginning August 15th, and closing August 21st. Prof. C. A. Young, of Princeton, presided.

—When a kerosene lamp is turned down low, the small flame is not sufficient to cause draft enough to ensure perfect combustion, and the result is the diffusion of vapors, the effects of which upon the health are well known to be evil. It is not a safe practice.

—Sea water differs a little in weight at different places, but at the same spot it is nearly the same at all depths. It may be estimated at sixty-four pounds to the cubic foot, or 1¾ pounds per cubic foot more than fresh water. The additional weight is chiefly common salt. Salt water freezes at 27° Fahrenheit.

—A new vegetable parasite, *Haplococcus reticulatus*, has been recently discovered in pork by Dr. Zopf. It occurs in from thirty to forty per cent. of the animals examined. Would it not be well if we paid more attention to the sanitary legislation of Moses, a fragment of the ancient medical law of Egppt?

—The Volta prize of $6,000 will be awarded by the Academy of Sciences, Paris, in December, 1887, under the decree of June 11, 1882, for the discovery or invention of whatever shall render electricity applicable economically to one of the following objects: Heat, light, chemical action, mechanical force, the transmission of messages, or the treatment of sick persons.

—Prof. W. F. Barrett, of Dublin, has been making some interesting experiments to test the correctness of the discovery claimed to have been made by the late Baron von Reichenbach, viz., that a peculiar luminous effect resembling a faint electric discharge in rarified air, emanated from the poles of a magnet, and was rendered visible in a perfectly darkened room. These new experiments confirm those of Reichenbach.

—London papers say that "the Secretary to the Royal Botanical Society recently tried the novel experiment of planting sea weeds in ordinary earth. It would naturally be supposed that these ocean plants would not flourish away from their native element; but this is not the case, most of the specimens planted having grown admirably in soil which is constantly kept in a moist condition." The result is both curious and suggestive, and worthy of trial this side of the ocean.

—An interesting experiment, illustrating the force of inertia and molecular resistance, is given in *La Nature*. It was first performed, and with a practical purpose, by a Corsican, under the second empire. Place a sealed piece of wax on an anvil, or well-supported iron plate, and over it a round ball of cast lead (not compressed), of diameter corresponding to its width. Now give the ball a sudden violent blow with a hammer. The flattened ball is found to have taken the impression of the sealed wax in its least details, and without breaking it (if the experiment is properly done). With the aid of this matrix the seal may be copied.

—Researches relating to sounds produced by a stream flowing through a circular hole at the lower end of a long tube containing liquid have shown that the pitch does not change gradually, but that a definite number of distinct notes are heard successively as the liquid column shortens by the outflow. The pitch depends on the length of the liquid column and on the velocity of efflux. The number of vibrations is proportional to the velocity of efflux; and the sound is pure only when the sound of the vein is one of the proper sounds of the liquid column. A column of constant length gives notes in a harmonic series. When the sound is reinforced by the column of air above it becomes quite loud. If the walls of the tube are prevented from vibrating, the sound ceases. The relative velocity of sound in different liquids may be determined by finding the lengths of the columns of liquid which give the same note, and the results thus obtained will be found to agree very well with determinations by other methods.

Practical Hints.

—To make a black dye for wood, first sponge the wood with a solution of chlorhydrate of aniline in water, to which a small quantity of copper chloride is added. Allow it to dry, and go over it with a solution of potassium bichromate. Repeat the process two or three times, and the wood will take a fine black color, unaffected by light or chemicals.

—The government method prescribed for cleaning brass, and in use at all the United States arsenals is said to be the best in the world. The plan is to make a mixture of one part common nitric acid, and one-half part sulphuric acid in a stone jar, having also ready a pail of fresh water and a box of sawdust. The articles to be treated are dipped into the acid, then removed into the water, and finally rubbed with sawdust. This immediately changes them to a brilliant color. If the brass has become greasy, it is first dipped into a strong solution of potash or soda in warm water; this dissolves the grease, so that the acid has free power to act.

—A new screen, or corner stand, consists of an excellent imitation of a turf with a portion of a mahogany picket fence and gate arising from it. The gate is padlocked with a steel hasp and lock, and has steel hinges. Over the gate climbs a fox having in his mouth a hare that he has evidently caught in the garden, from which he would escape. A vine growing up on either side the

gate adds to the delusion. The entire thing is about five and a half feet tall. A tripod from which to suspend a basket of flowers, is made from a hoe, rake and flail crossing each other near the top and having a sickle carelessly attached at this crossing point. Others are made of oars, sculls and boat-hooks.

— A Paris correspondent writes that crocodile-skins are now combined artistically with plush for photograph frames. A broadish flat frame with beveled edges is decorated with either gilt tooling as used in bookbinding, with colored leather mosaic, or with a metallic application in high or low relief, whether a design or a garland of flowers. The application does not surround the frame; it occupies one corner only, and runs half way up and along two sides of the frame. Plush, with the grain of Morocco or Russia leather, is employed very effectively in these frames. Again, you may have an entirely metal frame reproducing the grain of the plush or of the leather with the application of flowers. The progress of galvansplashe and the employment of metalized plants as natural models enables articles of this composition to be produced very cheaply.

Notes and Queries.

In continuing this department, which has been found of so much value, we would remind our readers who wish for information on any of the arts and sciences, that they are cordially invited to make their wants known through this column, and those of them who can furnish accurate answers to questions asked are requested to send in replies. Doubtless many of our subscribers may know of methods, processes, or devices that may be better or more suitable for the particular case in question than anything generally known, and it is this reason that induces us to keep this department open for a medium, where an interchange of ideas and practices may be made to the advantage of all our readers. Correspondents will please send their full address when forwarding their communications—either questions or answers—not for publication, unless expressly so stated, but so that we may know where to find the writer if desirable. Communications should be sent in on or before the first of each month previous to publication, to insure insertion in next issue.

Answers.

104.—Buy your tools of a good maker. Avoid cheap article —especially edge tools. If you purchase of any good maker or dealer, several of which advertise with us, and a fault is afterwards found, the tools will be exchanged. In fitting up a workshop, purchase your implements as you require them; by doing so you avoid unnecessary expense. If you are only a beginner, do not attempt to grind your tools; have them ground at some tool shop, the cost for each is only a trifle; if you think you can grind them yourself, buy a good stone at once, and always grind with the stone running towards you, otherwise you will have a wire edge. Do not sharpen your gouges on an oil stone, or you will not be able to sharpen your chisels properly; use a slip for the gouges, a flat stone for the chisels and plane-irons, a small slip for inside tools. If a new gouge slip be purchased, a good plan is to make a wide groove with an old file in the place you wish to sharpen your gouge; by doing so you obtain a straight groove, and possibly prevent cutting the fingers. In sharpening the tool do not hold it above the place where the gouge passes backwards and forwards, or a slip may occur and a nasty cut be the result. The best stones for turners and carvers are Turkey, Arkansas, and Washita stones. We do not think anything is better than a good piece of Turkey, but opinions differ, and some prefer Washita. Both are good for fine work. For coarse work, the Arkansas stone will be found very useful.—Ed.

105.—A writer in *Knowledge* describes a method of taking the impression of leaves and flowers as follows:—Procure a small bottle of oil (I always use olive), a camel's-hair brush or a piece of rag, half a dozen sheets of white unruled copying paper, a few sheets of white note paper, and a good old-fashioned tallow candle with a large wick. Take the leaves you wish to perform upon and put them under a press or in a large book, so as to get them with a fairly even surface. Then take a large sheet of copying paper and oil it completely by rubbing it with your rag, taking care not to put on more oil than is necessary. When this oiled paper is fairly dry hold it over the candle so that the flame just touches it, moving it about to prevent scorching. Do this until a fine layer of carbon, equally black everywhere, is deposited. When the light of the candle can just be seen through the carbon lay the paper on a table with the black side uppermost. Then place the leaf between a piece of the black paper cut to the proper size and another sheet of paper. After rubbing the upper sheet carefully, place the leaf between two clean sheets of paper. By again rubbing the upper sheet a complete impression of the leaf, with even the most minute veins marked in black, will be produced upon the sheet of paper. If this is allowed to dry it will not smear, and will always retain its freshness. Care should be taken not to allow the leaf to be chipped while on any of the sheets of paper.—X.

106.—There is a way of squaring numbers by complement and supplement, if that is what you mean by the American system. We first met with it in a little work called "Lightning Arithmetic," published in San Francisco by G. Frusher Howard. You take the ten next before the number, add to the number to be squared the difference between it and the ten, multiply that by the ten, and then square the difference you got at first and add it to the result. Thus to square 13 you take the nearest ten behind it, which happens here to be 10, subtract it from 13, and get 3; then you add 3 to 13, and multiply by 10—in other words, $13 + 3 \times 10 = 160$; and then you add the square of three, namely, 9, so that the full calculation runs $(13 + 3 \times 10) + 9 = 169$. In large numbers the gain is great, thus—1007 squared $= (1007 + 7 \times 1000) + 49$, or 1,014 049. This is called squaring by supplement: squaring by complement is taking the ten next in front of the number, and subtracting instead of adding. Thus 993 squared would be $(993 - 7 \times 1000 + 49 = 986{,}049$.—California.

107.—The following hints regarding pigeons may be of service to "Subscriber," though, as a rule, pigeons will thrive and multiply under any reasonable conditions: The loft should at this time of the year be kept as tidy and clean as possible, and care should be taken that the fountains and food utensils are clean as well. Nothing is so likely to breed disease as polluted water. Fresh rain-water is better for the birds than hard or river-water, but let them have it in abundance. Continue summer feeding, and do not forget the salt-cat or salt earth so necessary for the health of the birds. This is best placed in a small box kept for that purpose, and constantly replenished when empty It may be composed of three parts of old lime rubbish—which can generally be easily enough procured from any place where building is going on—and one part of coarse salt, with a little dry clayey earth. See that your pigeon loft has plenty of fresh air; if it has not, some plan of ventilating should be adopted forthwith. A good layer of sawdust with which a little

turpentine has been mixed, if placed in the nests, is a good preventive against vermin.—SAM R.

107.—The Camera Lucida is simply a four-sided bar of glass, with two of its faces at right angles to each other, and the other two at an angle of 135°. The glass is held with the right angle upwards, and the eyes being directed down upon the surface, see, reflected from the sloping sides, the object down the tube of the microscope, or whatever the instrument may be. A Camera Obscura is a rectangular box with a lens, whose focal length is equal to the length and depth of the box. This has a reflector fixed at half a right angle behind it, and this throws the image of the object towards which the lens is directed on to a piece of ground glass fitted into the top of the box.—Z.

Queries.

108.—I want to do some gilding of letters and ornamental work on glass, and if some fellow-reader who is "up to the business" will give me a little information on the subject, he, or she, will confer a favor on an AMATEUR.

109.—How are sea-shells bleached and made to look so clean?—SADIE.

110.—Please answer the following question through the YOUNG SCIENTIST: If a large dwelling, containing nineteen rooms, besides kitchen appointments, and is standing apart from any other building, and is surrounded by trees and shrubbery, is it not a villa?—DISPUTE.

111.—A few hints from any competent reader on the construction of an Æolian Harp will be thankfully gobbled up by a young WOOD-SPOILER.

112.—Will some one kindly explain to a dull boy what is meant by *specific gravity*, and oblige an old subscriber.—JUMBO.

113.—Is it known when the manufacture of glass first began?—ANTIQUARIAN.

114.—I would be pleased if some reader of the YOUNG SCIENTIST would inform me who wrote the following lines:—

"Yes, this is Love, the steadfast and the true,
Th' immortal glory which hath never set;
The best, the brightest boon the heart e'er knew;
Of all life's sweets the very sweetest yet!
O, who can but recall the eve they met
To breathe, in some green walk, their first young vow,
While summer flowers with moonlight dews were wet,
And winds sigh'd soft around the mountain's brow,
And all was rapture then which is but memory now."

—KATIE B.

Market Report.

Retail Prices.

IMPORTED CAGE BIRDS.

Canaries, *Belgian*, per pair	$6.00 to 15.00
" *French*, per pair	6.00 to 15.00
" *German, Hartz Mts.*, each	2.50 to 10.00
Gold Finches, each	1.50
Gold Finch (mules), each	2.50 to 5.00
Bull Finches, not trained, each	2.50
Bull Finches, trained to sing two tunes, each	10.00 to 40.00
African Finches, per pair	2.50 to 5.00
Chaffinches each	1.50
Talking Mino or Mina	10.00 to 25.00
Linnets, each	1.50 to 2.00
Linnets (mules), each	2.50 to 5.00
Green Linnets, each	1.50
Java Sparrows (blue), each	1.50
Java Sparrows (white), per pair	6.00 to 8.00
English Sparrows, per pair	1.00
Siskins, each	1.00
Gray Cardinal, each	4.00 to 5.00
Nightingales, each	8.00 to 25.00
Japanese Nightingales, each	5.00 to 10.00
Thrushes, each	5.00 to 7.00
Skylarks, each	5.00
Troopials, each	7.00 to 12.00
European blackbirds, each	5.00 to 7.00
Black-caps, each	4.00
Starlings, each	4.00 to 6.00

PARROTS.

Gray Parrot	10.00 to 15.00
Single Yellow-Head Parrot	8.00 to 12.00
Double Yellow-Head Parrot	10.00 to 15.00
West Indian "	4.00 to 5.00
Cockatoo (white)	18.00
Australian Shell Paraquets, per pair	6.00
"Love Birds," African Paraquets, per pair	6.00
West Indian Paraquets, per pair	3.00 to 5.00

All birds that are accomplished singers or talkers bring high and "fancy" prices. Parrots are rated by the number of words, sentences, and tunes they have learned.

AMERICAN CAGE BIRDS.

Canaries, each	2.50
Mocking Birds, females, each	1.00
" " singers	12.00 to 25.00
Robins	2.50 to 5.00
Blue Birds ("Blue Robins") each	1.50
Indigo Birds, each	1.00
Nonpariel, each	1.50 to 2.00
Virginia Cardinal, each	2.50 to 3.00
Bobolinks, each	1.50 to 2.00
Yellow Birds, each	1.50 to 2.00

Prices Paid by Dealers.

Robins, per hundred	12.00
Blue Robins (Blue-Birds), per pair	0.35
Indigo Birds, each	0.50
Bobolinks, per dozen	3.00
Yellow-Birds, per hundred	12.00
Orioles, per hundred	25.00 to 35.00
Virginia Cardinals (Red-Birds), each	0.75 to 1.00
Nonpareils, each	0.75
Blue-Jays, each	0.35
Scarlet Tanagers, each	1.00
Red-Winged Starlings, or Black-Birds, each	0.25
Woodpeckers ("High-Holers"), each	1.00
Partridges, each	1.50
Cranes, each (according to variety)	10.00 to 20.00
Wood-Ducks, per pair	2.50
Wild Bronze Turkeys (one cock, two hens)	10.00 to 15.00

FANCY POULTRY.

Guinea or Pea-Hens	12.00
Pheasants, *English*, per pair	20.00
" *Golden*, "	35.00
" *Silver*, "	30.00
Pea-Cocks, per pair	20.00 to 75.00
Bronze Wild Turkeys	15.00 to 20.00
White Turkeys	10.00 to 15.00
Bantams, trio	3.00 to 10.00
Ring-Doves, per pair	1.50
Pigeons, *common*, per pair	0.75
" *all white, common*, per pair	1.00

BIRD FANCIERS' MATERIALS.

Breeding Cages (double)	1.50 to 4.00
Trap Cages	0.75
Wire " painted	0.50 to 4.00
Wood and Wire Cages	1.50 to 4.00
Prepared Bird Food, per quart	0.30
Bird Gravel, per quart	0.05
German Rape Seed, per quart	0.20
Canary Seed, per quart	0.20
McAllister's Mocking-Bird Food, 1lb. jar	0.35
" Canary-Bird Food, 1lb. box	0.20
" Mixed Bird Seed, 1lb. box	0.10
" Extra Silver Bird Gravel, qt. box	0.10
McAllister's Prepared Fish Food, per box	0.10
" Song Restorer, for birds, per bot.	0.25
McAllister's Bird-Lice Destroyer, in patent bellows box	0.25
McAllister's Bird Lime, per box	0.25
Cuttle-Fish Bone, each	0.05
Meal-Worms, per hundred	0.40
Nest Boxes, wire and tin	0.10 to 0.15
Nest Material, per bunch	0.10

QUADRUPEDS.

Terriers, *black and tan*, each	5.00 to 30 00
Terriers, *Scotch and Skye*, each	5.00 to 30.00
Newfoundland Pups, each	10.00 to 15.00
Pomeranian or Spitz "	5.00 to 15.00
Greyhounds, *English*, "	10.00 to 25.00
Greyounds, *Italian*, "	10.00 to 30.00
Guinea-Pigs, *common*, per pair	1.50
" " " large	1.50 to 3.00
Guinea-Pigs, *all white*, "	2.00
Squirrels, *gray*, "	5.00
Squirrels, *all white* "	15.00 to 25.00
Squirrels, *flying* "	3.00 to 4.00
Squirrels, *small red* "	2.00
Rabbits, *common*, per pair	1.00 to 2.50
Rabbits, *fancy breed*, according to age and purity of breed, per pair	3.00 to 15.00
Ferrets, *English*, "	15.00
Raccoons, each	4.00 to 5.00
Cats, *Maltese* (males), each	5.00
" " (females), each	3.00
Cats, *Albinos, pink or blue eyes*, each	3.00 to 5.00
Rats, *white China, pink eyes*, per pair	1.50
Rats, *piebald*, per pair	1.50
Mice, *white, pink eyes*, per pair	0.50
Mice, *piebald*, per pair	0.50

Prices Paid for Pet Stock by Dealers.

Guinea-Pigs, per pair	$0.40
Squirrels, *gray*, each	0.50
Squirrels, *flying*, per pair	0.75
White mice, per pair	0.15
Monkeys, according to variety	15.00 up.

MARINE AQUARIA STOCK.

Purple Bermuda Anemone	2.00
Fringed Sea Anemone, Medium-sized specimens	1.50
White-Armed Anemone	0.50
Small Orange "	0.10
Buccinum Snails, per dozen	0.25
Silver Shrimp, each	0.10
Small Hermit Crabs, each	0.15
Small Spider Crabs (decorating)	0.15
Very Small Edible or Blue Crabs	0.20
Barnacles, each	0.15
Nest-Building Stickle-Backs, three and nine-spined, per pair	0.30
Sheepshead Lebia fish	0.25
Killie-Fish	0 10
Eels	0.10
Sea-Horses, each	3.00
Pipe-Fish, "	0.25
Serpulæ, per mass	0.75
Small Edible Mussels, per mass	0.25
Sea Cucumbers	1.00
Sertularia, per mass	0.25
Tubularia, per mass	0.25

ALGÆ (SEA-WEEDS), FOR THE MARINE AQUARIA.

Ulva, per mass	0.25
Solaria, "	0.25

FRESH WATER AQUARIA STOCK.

Stickle Backs, Nest-building, per pair	0.30

Plants, per bunch	0.15	Small Turtles, each	0.25
Shells, per quart	0.50	Snails, per dozen	0.10
Small Dip-Nets	0.50	Frogs, each	0.15
Aquaria Cement 1lb. box	0.30	Fresh-Water Mussels	0 05

Valisneria Spiralis, per bunch	0.25	For the Microscope and Fresh Water Aquarium.
Nitella-Flexilis, "	0.25	
Anacharis, "	0.15	
Ball Plant (Utricularia)	0.15	

Small Rock Sun-Fish, Rock-Fish, Sun-Fish, Dace, Cat-Fish, Tadpoles, Eels, Lizards, each	0.05

Gold-Fish, medium size	0.15	These are all varieties of the golden carp or gold-fish.
" fountain size	0.25	
" very small	0.15	
" three-tailed	0.50	
Pearl-Fish	0.25	
Silver-Fish	0 05	
Japanese King-gio	2.00	

Prices Paid by D

Aquarium fish, per hundred	1.50
Gold Fish, per hundred	5.00 to 6.00
Aquarium Plants, per hundred bunches	2.00

BEAUTIFUL AND INTERESTING AQUATIC AND SEMI-AQUATIC PLANTS FOR ORNAMENTATION OF PONDS, LAKES, AQUARIA AND FOUNTAINS.

White Water-Lily, per root	0.25
Yellow " "	0.25
Arrowhead Lily, 6 plants	0.25
Calla-Lilies	0.25
Pitcher-Plants, per root	0.25
Fresh-Water Cattails, per root	0.25
Giant Rush " "	0.25
Floating Heart (Limnantheum), per root	0.25
Calamus (sweet-flag), per root	0.25
Water-Cress, cuttings	0.25
Jack-in-the-Pulpit, 6 bulbs	0.25
Lobelia Cardinalis	0.25
Large, Showy Blue Lobelia	0.25
Water Violet (very curious)	0.25
Antipyretica Gigantia, interesting	0.25
" Fontinallis, interesting	0.25
The Water Net	0.25
Large Living Frogs	0.10

SHELLS.

Collections of small "cabinet" shells for schools, private cabinets, range from $5.00 to $50.00.

Mother-of-pearl shells, for painting, 75 cts. to $1.50.

Single specimens of cabinet shells range from 15 cts. each to $3.00.

Masses of corals, 25 cts. to $3.00.

Green snail and cowry, with the Lord's Prayer engraved on them, 50 cts. to $2.50 each.

Conch shells, for mantels or hearthstone ornaments: West India Conch, 25 cts.; East India Yellow Helmet, $1.00 to $2.50; Bahama Black Helmet, 50 cts. to $1.50; Bahama Hatchet Helmet, 50 cts. to $1.25. These shells are also for cameo engraving. Zanzibar Cameo, 25 cts. to $1.00.

Ground and polished shells: New Zealand Green Ear, 50 to 75 cts.; New Zealand White Ear, 50 to 75 cts.; Japan Black Ear, 50 cts. to $1.00; California Red Ear, 75 cts. to $1.25.

Fine shells for fancy work, according to colors and variety, per quart, $1.00 and up.

Fancy Wood for Scroll Sawing.

The prices given for the various woods used in this work are for the best of qualities of seasoned material, planed on both sides, ready for immediate use. They can be furnished in quantities to suit purchasers. Prices are by the square foot, and vary according to thickness of material.

DESCRIPTION.		THICKNESS. 1-8	3-16	1-4
Black Walnut	Per Ft.	7	8	10
White Holly	"	10	12	14
Oak or Ash	"	8	10	12
Mahogany	"	10	12	14
Red Cedar	"	10	12	14
Rosewood	"	18	20	25
Satinwood	"	25	30	35
Birds'-Eye Maple	"	15	18	20
Tulip	"	30	40	50
Ebony	"	50	60	70
Cocobola	"	20	25	30
Amaranth	"	20	22	25

BEST IMPORTED SAW-BLADES. 5 INCHES LONG.

Sizes to No. 6, per dozen	10c
" " " gross	$1.co
" No. 7 and 8, per dozen	15c
" " " " gross	1.25
" No. 8 and 10, " dozen	oc
" " " " gross	1.50

For all information on this subject, as to reliable dealers, etc., etc., send postal card to YOUNG SCIENTIST. When desired, the goods can be sent through this office, but in all cases remittances must accompany the order.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business matter in letters or cards they are filed away and never reach the printer.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

A number of first-class tricks, trick books, stamps, coins, Confederate money, curiosities, etc., to exchange for stamps or pet stock, such as rabbits, Guinea pigs, or squirrels. J. S. Reese, 52 Cedar St., Canton, Ohio.

Shell boat, Spanish cedar, 28 feet long, spoon oars; good order; been used but little; for offers. J. W. B., Carmel, N. Y.

Rowing machine, cost $10; photographic outfit, $16; Flobert rifle, $15; medical battery, $10; "Wood's Botany," etc.; for elk horns, deer horns, minerals, Indian relics, and all kinds of curiosities; would like list of curiosities from dealers. Chas. C. Collier, 3617 Locust St., Philadelphia, Pa.

Vol. III. of the *American Machinist* for the best offer of minerals. J. A. S., P. O. Box 83, East New York.

I have five or six complete years of the *Galaxy* (magazine) also a number of odd copies; I will exchange the lot for an induction coil in good condition, and giving at least a ¼ in. spark. W. B. Greenleaf, 480 La Salle Ave., Chicago, Ill.

I have eighteen numbers of the *Harper's Young People* (79 to 96 inclusive), containing part of the story "Tim and Tip," by James Otis, and all of the story "The Cruise of the Ghost," to exchange for a good spyglass, a good bull's-eye lantern, or a small telephone. J. H. Gamsey, Box 25, Wilmington, Will. Co., Ill.

A good violin, bow, box, books, all complete, worth $12.00, to exchange for Wood's Botany, Young Mechanic, or scientific books and papers; send list. A. D. Chamberlain, Trout Creek, Del. Co., N. Y.

A model self-inking printing press, chase 2½ x 3¼, 4 fonts card type, 3 type cases, ink, roller and furniture all in good order, to exchange for a good silver watch and nice chain. G. E. Wilmot, Box 88, Lebanon, N. H.

Any person wishing to exchange foreign stamps please send sheet and I will return it with mine. Box 90, Melrose, Mass.

New Nickels (without "cents") for offers; I also wish to exchange with curiosity, coin and stamp collectors residing in foreign countries. G. S. Griffin, Moline, R. I. Co., Ills.

1 Sea bean, 1 alligator's tooth, 1 small cocoanut, 1 liver bean, lot of other beans and shells and 50 foreign stamps for a printing press and outfit, size of chase about 6¼ x 4 inches; send postal. Geo. O. Riphard, Westminister, Md.

W. C. Roseboom, Cherry Valley, N. Y., wishes to exchange with amateur photographers, or others; photographs and pictures taken by themselves, mounted or unmounted; give name of picture and camera.

I would like to exchange minerals, stamps and curiosities for the same. O. J. Lache, 1313 Poplar St., Philadelphia, Pa.

6 fonts type, 4 cases, 2 composing sticks, leads, rule, etc., outfit except press, to exchange for good tent, not less than 6 x 6, or offers; send card before exchanging. Wm. O. Brown, Middlebury, Vt.

I have double barrel muzzle-loading shot gun, watch, orguinette, harmonica, stuffed birds for Household microscope, photo. outfit, books on natural history; specimens or offers. E. O. Tuttle, Bristol, Vt.

A printing-press, chase 5½ by 7 inches, in good order; will exchange for a large self-inking press or type. A. W. Barrett, Canajoharie, N. Y.

A one-keyed flute and pair of No. 10 club skates for rifle; E-flat cornet, cost $25, for an eight or six-keyed flute of equal value; all good; or offers. J. L. Pilkington, Pearsalls, L. I.

For fossils or minerals; fine specimens of Pentremites—two varieties—from sub. carb. rocks; also Flobert rifle, in good condition, and McKinnon pen. M. H. Crump, Bowling Green, Ky.

I have for exchange a collection of about 80 species of fine fossils, all named and making a fine collection, which I wish to exchange for opera glass, microscope, telescope, or offers; correspondence solicited. A. Stapleton, Box 756, Seneca Falls, N. Y.

Wanted, amethyst, moss agates, trilobites, geodes, coral, and coal ferns in exchange for fifty Indian arrowheads, coquina rock and Florida moss. E. V. Sheerar, Wellsville, N. Y.

"Crystallography" (40c.); "Electricity" (40c.); "Selection and Use of Microscope," abridged, (30c.) Either in exchange for "Workshop Companion," or two for "The Microscope," by Ross, or offers. C. H. Denniston, Pulteney, N. Y.

Home Medical Battery, cost $7; Lemair's Field-Glass, No. 2202 of Queen's Catalogue, cost $15.50; Achromatic Spy-Glass, power 25 times. To exchange for books or offers. Emerson Heilman, Heilmandale, Pa.

A small collection of coleoptera, comprising 100 species and 300 specimens, all correctly named, in exchange for bird-skins, insects, books, or eggs. Emil Laurent, 621 Marshall St., Phila., Pa.

A small magic lantern, Ruby pattern, with twelve slides, for a good book on Entomology, with illustrations. Willie R. Hotchkiss, Morrisdale Mines, Clearfield Co., Pa.

Wanted, Thompson's "Witchery of Archery." Must be in good condition. Write before you send. J. Anthony, Jr., Coleta, Whiteside Co., Illinois.

A telescope worth $3.50, for a self-inking printing-press and outfit; chase not less than 2½ by 3½ in. Eddie Judd, 260 Connecticut St., Buffalo, N.Y.

To exchange for offers: $20 scroll-saw, Seneca Falls make, $4 Bailey circular plane, set of Auburn metallic planes, brass-bound four-foot rule, fourfold, Traut's patent combined plow, dado, etc., cost $7. F. A. Rappleye, P.O. Box 12, Farmer Village, Seneca Co., N.Y.

Bee Hive wanted; one of the old-fashioned straw "skeps"; say what you would like in exchange. Apis, care of Young Scientist, 294 Broadway, N. Y.

A first-class type writer, in excellent condition, cost $125.00, to exchange for good microscope, telescope, or valuable scientific books; send full particulars. A. B., Box 114, Lewiston, Maine.

A $30 stencil outfit (Spencer's) for a self-inking printing press in good condition, chase about 6 x 9; rich ores and minerals of Idaho for scientific and instructive books, printing press, type, etc. J. P. Clough, Junction, Lemhi Co., Idaho.

Wanted pyrites of iron from Colorado gold mines in exchange for sea shells and other gems; send list of what you have to exchange. S. Ferguson, Eureka Springs, Arkansas.

A banjo in good condition, two pairs of rosewood bones, three splendid games, and a fine set of drawing instruments, for a good cornet, viola, violincello or double bass. L. B. Hill, Kalamazoo, Mich.

Scientific specimens of various kinds for same. Geo. E. Frazier, Caldwell, Ohio.

Lester W. Mann, Randolph, Mass., Box 162, has Demas scroll saw, lathe and tools, emery wheel; $20 worth patterns; Smithograph; large harmonica, cost $1.75; novelties in seeds; for large self-inking press or offers.

10 volumes Chambers' Encyclopædia, American Book Exchange edition (cloth); Bonanza printing press, chase 3 x 5, card type, ink roller; spyglass, power 10 times; for French triplet, 1-5 in., or offers. H. P. Nichols, P. O. Address, Bridgeport, Conn.

A good telescope, also foot-lathe and saw combined, each worth $10 00, for shells, fossils or relics. Independent, Conncautville, Crawford Co., Pa.

Birds' eggs to exchange for others; send list of what you have to exchange. Emil Laurent, 621 Marshall St., Philadelphia, Pa.

Twelve or fifteen volumes of the American Agriculturist to exchange for scientific books or offers. W. H. Osborne, Chardon, Ohio.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

VOL. VI. NEW YORK, OCTOBER, 1883. No. 10.

How To Make Rubber Stamps.—II.

VULCANIZATION OF THE RUBBER.

THE plaster cast being now quite dry, our amateur stamp-maker may at once proceed with his work. If the stamp in hand be a very particular one, or if a large number are required—all to be cast from the plaster and of one pattern—it is usual at this stage to soak the cast for a few minutes in a weak solution of ordinary gum shellac and methylated spirit—a few cents' worth of each will be sufficient. This mixture fills up all the pores of the plaster, and leaves on it a polished and very smooth surface, besides making that fragile material almost as hard as a stone. But for ordinary work this process is quite unnecessary; in fact, it is rarely, if ever, employed, unless in the manufacture of very expensive stamps, such as daters, etc., which are expected to last for half a lifetime.

In either case the cast is now taken and replaced in the frame. Take two pieces of the specially prepared india-rubber, which is supplied in suitable sheets, cut them to the size of the stamp you require, and place them, one on top of the other, on the cast, rubbing the side next the plaster, and the back of the upper piece, with a little French chalk; but be extremely careful that none gets in *between* the pieces. Over the top piece put a piece of paper, about the size of the rubber or a little larger. Over all place plate like Fig. 1, with the pins turned downward, and square with the edges of the frame. Place this "pile" in the press, Fig. 2, carefully, keeping the edges square, and the centre of the pile directly beneath the screws, which you may tighten a little, to keep its component parts from moving about.

The vulcanization of the rubber, as it is called, may now be proceeded with. It is just as well to understand the "why"

and "wherefore" of this process, as it may truly be said that more time and money have been wasted in this part of the manufacture than in any previous part of the process. It consists, then, in applying heat to the india-rubber under pressure, in such a degree as to expel the sulphureous gas which permeates it, and no more. This has the effect, firstly, of turning the color of the caoutchouc to

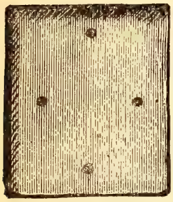


Fig. 1.—PLATE.

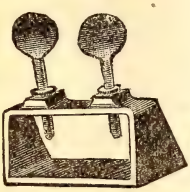


Fig. 2.—PRESS.

that slaty tint with which we are all so familiar; secondly, of rendering it beautifully elastic and pliable; and thirdly, to permanently retain the impression which has been imparted to it. The success of the operation depends in a small measure on the skill of the operator, and nearly altogether on the india-rubber employed. It is a mistake to endeavor to procure it at an ordinary rubber dealer's; they are ignorant of the use for which it is required, and thus may supply the purchaser with a wrong kind; or if they do happen to have it in stock, it will be very probably in the form of large rough blocks, utterly unsuited for the purpose.

Place the whole apparatus—press, frame, plates, and rubber, over a clear fire or a gas burner, whichever be most convenient. A Bunsen burner, size 2, in practice, will be found to be the best in the long run, the absence of soot and smoke being a very important item in the work. In this case the apparatus must be placed on an iron tripod, which may be bought at most druggists for twenty-five or thirty cents.

In either case, do not touch the press until the heat has thoroughly penetrated every part of it, which will take two or three minutes; then, taking an old piece of cloth between the fingers, gradually, carefully, and *evenly* screw down the press, at short intervals, until the four pins on Fig. 1 penetrate right through the layers of india-rubber, and at last rest on the upper edge of the frame. The press is now quite tight, and the screws can no longer be used; and now the operator can examine the rubber, a thin edge of which will be exposed between the plates. As soon—generally in about fifteen minutes—as the rubber turns to a blue color, it is a sign that the vulcanization is complete; and the whole apparatus must now be removed from the source of heat, and, with the parts still together, left to cool; or, if expedition is necessary, it may be placed in cold water. When it is quite cold, unscrew the press, take out the frame, with the rubber still adhering to the plaster in it, and carefully separate the rubber from the cast; they may stick together slightly, but it is only a chance. When separated, you will find that you have produced an absolutely faultless fac-simile in vulcanized caoutchouc of the original leaden type you used; in other words, you have made a RUBBER STAMP.

The only thing that now remains to be done is the mounting of the rubber on the brass or wood, as the case may be, fixing the same in a handle, and placing the whole in a box, with the pad and ink necessary for its manipulation.

The piece of brass is taken, and, by means of the square shank turned on it, forced into the hole in the handle; the rubber is then, after the edges have been trimmed with a pair of scissors, cemented on the brass with a thick solution of methylated spirit and gum shellac; it will be dry in one or two hours.

The cheaper stamps are all fastened on wood, which answers nearly as well as brass. Glue or cement may be used for attaching the rubber to the wood.

In the case of an oval or round stamp being required, an oval is bought of the size chosen, at a dealer in printer's materials, and being type high, and the centre and edge being left blank, or "pierced for type," the letters are put into it and wedged in their places by little pellets of tissue paper, small leaden spaces, or anything handy.

In practical business, half-a-dozen or more stamps are made at one operation, the wording of each being arranged as required, and the types put into the chase alongside of one another, so that name stamps, ovals, square stamps, and round will be next-door neighbors. A plaster-cast is then taken in the usual manner, as if only one stamp were being made, and a similar cast in india-rubber; the various stamps are then cut and separated from one another with a pair of scissors.

Overglaze Painting on Porcelain.—III.

BY AURELIO DE VEGA.

IN purchasing brushes to operate with, some care is necessary, and the following hints will doubtless be of service:

18. *Testing Brushes.*—Whatever kind may be selected, the best only of that kind should be used. It is impossible to produce a highly-finished work with bad tools. In a good brush, when dry, the body is perfectly elastic, and the hairs have a perfect spring, and lie equally together.

A brush should not be purchased without having been tested. Always test your brushes in water. If the seller does not proffer the jar of water, ask for it; if he does not produce it, do not buy. The water forthcoming, dip the hairs in it so that they become fully charged. Then holding the handle tightly between the ends of the thumb and second finger, suddenly depress the latter, retaining the brush between the thumb and the first finger. This jerk will send off the superfluous water, and then the brush, if good, will at its end present, if a round or small flat one, a fine point, if a large flat one, a fine, straight, or slightly-curved line, to which, in either case, the body has *regularly* decreased. If a round brush should, after this test, have protruding hairs in the body, or free hairs at the end, or a flat one have some parts of its line thicker than others or depressed, or the terminating point or line be not led up to gradually, reject it without further consideration; it is not a good brush.

19. A common test is to moisten the brush slightly in the mouth, and draw the hairs together through the lips. This is a procedure giving most uncertain results, not to mention an obvious objection to it. In a brush not absolutely worthless, but a long way from being thoroughly useful, the stickiness communicated by the saliva would impart to the hair-tips a certain amount of cohesion, causing a point which under the proper test would never form.

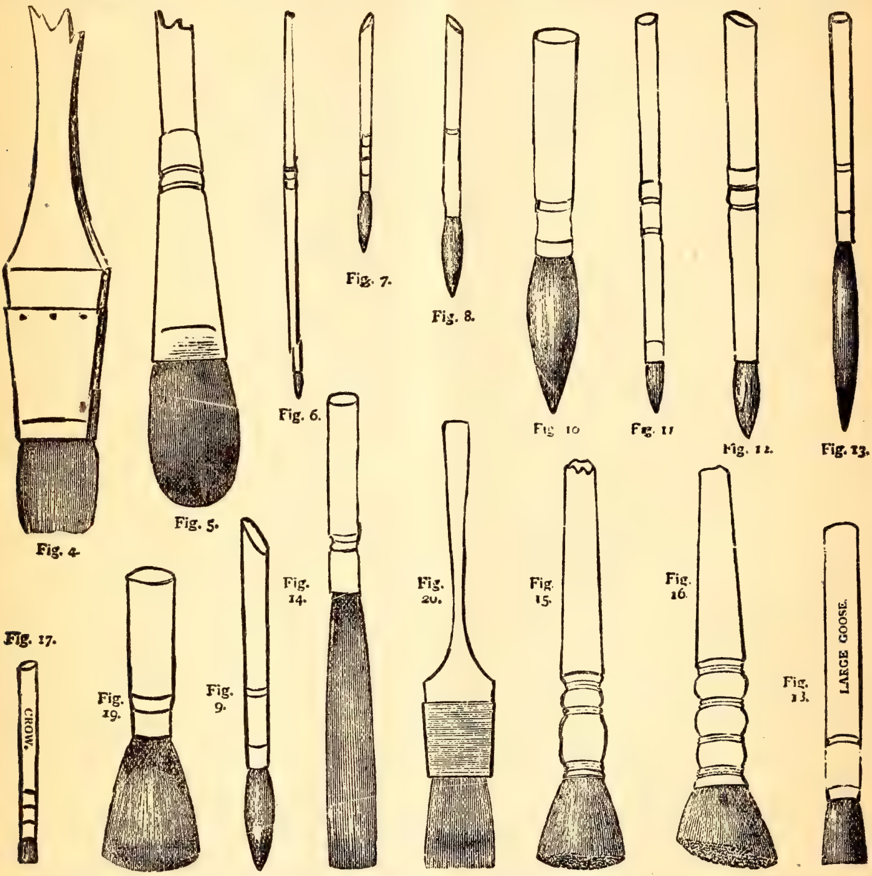
20. One further caution is necessary, and is addressed rather to those living in the country. It may be that a piece of work is in hand which it is desired to finish quickly, but through some accident the suitable brushes have become useless. For convenience, application for new brushes is made at the nearest shop professing to sell artists' materials. Now, a good many of the small and pretty numerous shops which make this profession act up to it, and at them serviceable tools may be obtained; but others, I am sorry to say, do not, and at these one may meet with brushes already presenting a very good point, which, alas! is more frequently than not the result of the addition of a little mucilage to the water with which the hairs have been moistened. In this case the hairs are a trifle harsh and stiff. If you cannot conveniently search elsewhere, rub the brush between the fingers to remove the powder, and test with water as above suggested. A good one may possibly be found among the lot.

21. *The Shape and Size of the Brush to be employed.*—These particulars will depend upon the nature of the work and the extent of the surface to be covered, and hence there is great variety in these respects.

22. *Skies, Water, and Grounding.*—For skies, and water in which there is a pretty large sheet of color, either of one intensity or graduated, and to be left as laid, or to have the clouds or lights picked out, a flat brush, as shown in Fig. 4, is generally about the best; but in smaller or somewhat irregular work, that shown in Fig. 5, which is often called a sky brush, is perhaps most serviceable. The size should be such as to allow of enough paint being

taken up to give a complete line of full width. Fig. 5 is also well suited for washing in large masses of foliage. Either brush answers well for backgrounds or ground-laying.

23. *For General Use in the ordinary run of Painting,* the brushes or pencils depicted in Figs. 6 to 12 will be found most two smaller than that represented, are useful in large shading, such as broad draperies in big paintings, and in foregrounds. Fig. 11 is a shortish, flat sable, highly useful in giving crisp touches with paint rather stiffer than usual. Fig. 12 is an ordinary round sable. Both these last are in metal settings. With regard to



BRUSHES.—Figs. 4, 5—Water or Sky, Washing In or Grounding Brushes. Fig. 6—00 Miniature Sable. Fig. 7—Small Finisher, Camel Hair. Fig. 8 - Small Rose, Camel Hair. Fig. 9—Special Rose, Camel Hair. Fig. 10—Large Shader, Camel Hair. Fig. 11—Flat Short Sable. Fig. 12 - Round Ordinary Sable. Fig. 13—For Lining or Tracing. Fig. 14—Bander. Fig. 15—Dabber, flat top. Fig. 16—Dabber, skew top. Figs. 17, 18—Superfine Fitch Hair Brushes. Figs. 19, 20—Softeners.

serviceable, the sizes varying according to the size of the work in hand. Fig. 6, an extremely fine sable, is for the most delicate work in the features of small faces, such as nostrils, lips, the iris, etc. Figs. 7, 8, and 9, in quills, are of sizes very generally useful. Fig. 10, and a size or the difference between round and flat brushes, it may be stated that the latter are often a little more useful in a skilled hand, as a greater variety of stroke and touch can be given with them. This point will be further noticed by and by. Both sables and camel-hair may be ob-

tained in quills or set in metal or albata. The first are the cheapest, and are of excellent quality. The last, no doubt, look best, and in the very small sizes are rather preferable, as greater care is supposed to be taken in the fixing, etc., of the hair. The metal does not corrode.

24. *Liners, Tracers, and Banders.*—Fig. 13 represents a brush known as a liner. This has very long hair, and is a fine and very supple brush, capable of holding, for its diameter, a very large quantity of paint. This is a necessity met by the length, as otherwise the point would be likely to dry. It is used for drawing circular lines round plates or vases, and may be had in three or four sizes. A somewhat similar brush, with shorter hair for the same diameter, is made for tracing and drawing outlines. With a little practice either answers very well for the other. Fig. 14 also comes into use in circular work, and with it bands of color are described. The possession of it is not, however, an absolute necessity, as with experience a large liner can be made to do its work. These brushes should be of a size that when well filled will enable the painter to do a complete circle, whether line or band, without stopping to have to replenish the brush.

25. *Dabbers.*—The foregoing are brushes used in actually laying the paint on the ware. There are others required for distributing it *when such an operation is necessary.* These are Fitch brushes, or Dabbers, and Softeners (see Figs. 15 to 20). The former are employed to render even a coat of paint which it is perhaps impossible, owing to irregularities in the surface of the ware or from some other cause, to lay quite flat with the painting brush. The large ones are in two shapes. The flat-headed ones are for use on flat or convex surfaces, such as the middle portion of plates and dishes, and the round of vases, etc. Those with a skew top, which is slightly convex, are for concave parts, such as mouldings of plates and other hollows. These two kinds are for ordinary work. The small fine ones set in quills are for more delicate work.

26. *The Softeners* are brushes with very fine and soft hair, and, as their name implies, are used in softening tints and rendering them more delicate, and are most serviceable in such work as toning down the edges of clouds, producing graduated tints which vanish or mingle, one can scarcely see how, and often subsequently to the dabbers, to secure an evenness which they may fail to produce, and for which other processes that we shall have to notice are unavailable. These are made in badger and camel-hair, the former being a most excellent kind, and round or flat. Fig. 19 shows a round camel-hair.

27. *Cleaning* (*a.*) *Procedure.*—It may seem an excess of caution, not to say an impertinence, to urge the observance of cleanliness with regard to the brushes; and yet experience shows that it is absolutely necessary to do so, and in the strongest terms. Cleanliness is needful in everything connected with china painting, but in no department is it more so than in the treatment of the brushes. Many a good brush is ruined either by letting paint harden in it past the possibility of entire removal all at once, or by injudicious treatment after paint has dried in it. To prevent the occurrence of this condition, one course is obvious: do not let the paint harden in your brushes. Those you have used during the day, clean when the day's work is done. While they are moist the labor of cleaning is not worth mentioning, and the time the cleaning will occupy is but short; if postponed till the morrow both will have increased. The brushes will be cleaned in turpentine. Ordinary turpentine, such as is procurable at paint stores, will do quite well, provided it be fresh and not oily. In cleaning up, as in everything else, there is a right and a wrong way. If you wish to spoil your brush, to cut the hairs or make them stick out like an Aztec's or become curly like a negro's, you will dab it down perpendicularly on to the bottom of the little dish or vessel containing your washing turpentine, but if you would retain it serviceable until fair wear and tear alone renders it otherwise, you will clean it by holding it in the turpentine slantways, at the angle at which a pen is ordinarily held in

writing, and will turn it on either side, gently pressing it against the vessel so as to squeeze out the paint. The same turpentine will clean several brushes if the paints in them are allied in composition, as to which we shall speak in due course. The plan I adopt, and which I have found economical, is to have a slant tile with three divisions; put a little turpentine in each, wash each brush singly on the higher part of the first slant, and when pretty free from paint draw it along a clean piece of rag and put it on one side. It will be found that the paint sinks to the lowest part of the slant. When all are washed once, repeat the process in the second slant. If the cleaning has been thorough, the turpentine in the third slant will not be at all tinged. It is necessary to state that a trace of one color in a brush may be sufficient to spoil another with which such brush is used. Some colors wash out less easily than others; thus, blue is rather persistent, while pink is very easily disposed of, and this consideration indicates the advisability of employing different sets of brushes for colors of different classes, which are mutually antagonistic.

At the same time a slip may happen with even the most methodical, and a brush may escape notice when the rest are having their bath, so that when discovered next day or so the paint has dried somewhat. Now in such case do not on any account bend the hairs to try and soften them, as doing so will not effect the desired purpose, but may break the hairs and spoil the brush. The proper way is to let it soak in turpentine for a moment, then hold it in front of a fire, or by the side of, *not over*, a gaslight until it softens. You will then be able to wash it in the ordinary way. If through the heat the turpentine has evaporated before the brush is soft, recharge the brush and hold it to the heat again.

It may be added that an occasional mild application of a little soap and water (without soda) is beneficial to the brushes. It should be administered but seldom, however, as frequent dosing results in spreading and curling the hair.

28. *Caution.*—In one little book on this subject I find that the student is recommended to have at hand a little bottle of *spirit of wine* in which to clean the brush, probably because this liquid is such a solvent for oils. It does too much, however, in one respect and not enough in another, for it runs the oil out, leaving behind the whole, or almost the whole, of the paint in clots or fine needles closely adherent to the hair and difficult to thoroughly remove.

29. *Receptacle for Brushes.*—If the brushes are, as they should be, kept in a separate box, say of cardboard, care should be taken that the box is somewhat longer (about a couple of inches) than the longest brush in it, and that when the brushes are put away the hairs are not pressed against the end, which would turn the points and render the brushes useless.

In the next paper Mediums and Paints will be dealt with.

(To be continued.)

Amateur Boat-Building.—V.

ALTHOUGH our "Hints" relate to river craft principally, the subject comprehends not only considerable variety in the form of boats used, but also in their quality, so to speak; and taking them in an ascending scale, we shall begin with the most primitive affair in which one can navigate, and finish with the more elaborate and capable boats.

Quite low down in the scale we must place the punt, and with this we had intended to begin. But a good punt is (or should be), after all, a really "built" affair—that is to say, although keelless, it has still its skeleton—the frames which give it solidity. And, therefore, there are boats of more simplicity than even the punt; one of which—rude, but riverworthy—we will speak of first.

There is another reason for this. It was in a craft of this sort we first took to the water, and it is the kind also which many an emigrant in a new country turns out to aid him in his journeyings or fishings.

A "dug-out," some one says. No; it is

not one of Robinson Crusoe's patent. That description of article demands too much labor.

In many of the older countries a man leases the rush harvest of a river. The greater rush (*Scirpus lacustris*) is of sufficient economic value to be worth purchasing the right to cut when mature. Its principal use is by coopers, who place one between each stave of a barrel to caulk it, so to speak. It is also used for mats, baskets, thatching, etc. Well—our boat was mainly built for "rushing;" and, while it held a good load, its draught was so little that it could be pulled over the shallowest of shallows.

To proceed. Choose two sound boards, free from knots, or what the carpenters call "shakes," ¾" thick, or thereabouts, 1′ 6″, or 1′ 8″ wide, and 12′ in length. These will form the sides of the proposed boat.

(We may here state that in all sketches and descriptions the sign ′ indicates feet, and ″ inches.)

First joint one edge of each board straight with the jack or trying plane. Then, by the aid of a broad-pointed carpenter's pencil, mark on both sides of each board the shape to be given at bow and stern, as at A and B, Fig. 1 (page 300). The curvature of the former should begin at about 3′ 6″ from the end of the board, and rounding gently upwards, should leave a depth of wood of about 9″ or 10″ at the bow, as shown in the illustration. For the stern an angle of about 15° with the bottom edge of the board will do (B, Fig. 1), beginning at about 2′ 6″ from the end of the board and slanting upwards to leave a depth of 10″ at B. Instead of marking off both boards, it can be done with one only, and when this has been brought to the required shape it may be laid on the other and marked round with the pencil, or still better with the point of a sharp awl. The plane may be employed to remove the wood to the required slope at B, but for the curve at A the draw-knife is the handiest tool, with a little care.

The boards are now to be placed together with their edges level, and the exact centre of their longest edges found and marked (C) on each board, and 5 inches set off on either side of this mark at D and E.

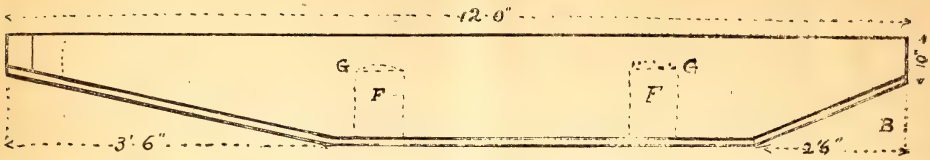
Where it is not practicable to get planks of sufficient width, two must be used for each side. In this case they must be grooved and tongued together. Two 9″ boards for each side will give rather a shallower boat than the one which we have described, or two 11″ boards, with about an inch planed off each, will make a rather deeper one. Inch red pine would do well.

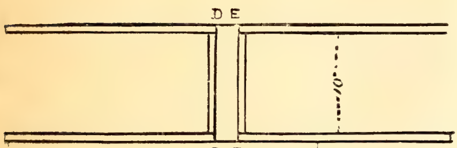
For the next step take a piece of ¾″ board 10″ wide and 3′ long. Let this be carefully squared at the ends, by the edges being first planed-up truly parallel, and the ends then marked off therefore by the aid of a square. This piece of board is to be securely nailed or screwed at each end to the edge of one of the long boards exactly above the spaces D E. Turn the pieces over bottom upwards, and nail another piece of board across the bottom precisely opposite the piece spoken of (Fig. 2).

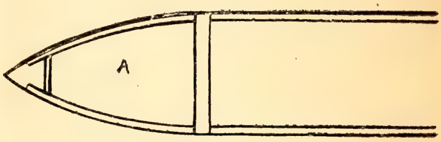
Next prepare the bow-piece (Fig. 3). This should be made of a good, hard, solid block of oak or other hard wood, thoroughly seasoned. This piece is shown by itself at Fig. 3, where A shows it as viewed from above, and B is a view lengthwise. It is triangular in plan, the two longer sides 10″, and the side which goes inside the boat 8″. Its depth should be about 11″, and it must slope off to a curve corresponding with the two boards. On each side from the inner end for a distance of 5″ the wood must be cut away for nearly 1″ in depth, as shown, which will leave a kind of rabbet for the bow-ends of the two boards to abut against. The piece of oak may now be placed between these ends, and they, when drawn close up in the recess of it, can be securely nailed thereto by large, strong nails. The affair will now present the appearance shown at A, Fig. 4, viewed from above. Copper nails are best.

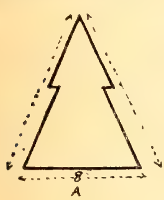
The stern-board can be now got ready. This may be 2′ long and 10″ in width, and must be, like the bow, of sound well-seasoned material (B, Fig. 4). It is to be placed between the boards at B (Fig. 1),

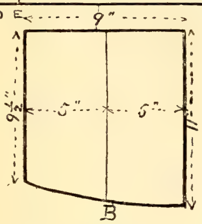
Fig. 1.

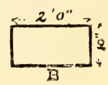


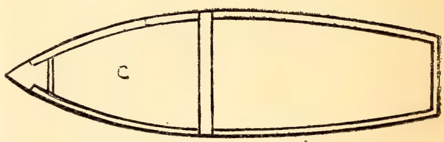


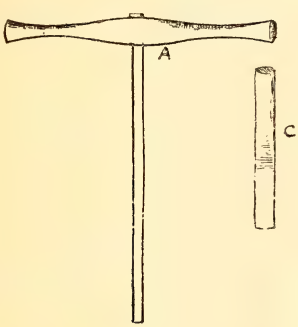












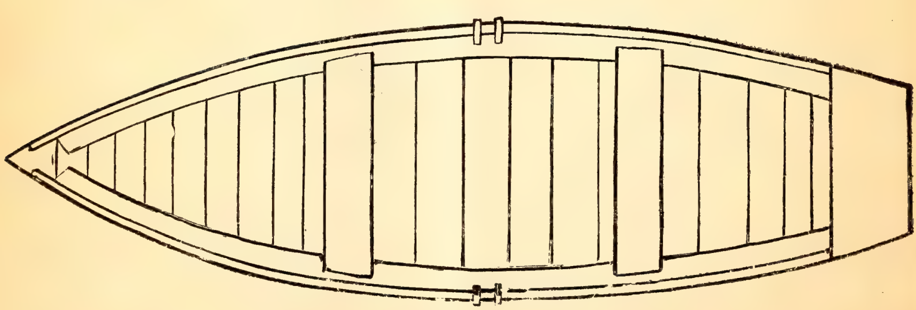


Fig. 6.

and each of the former securely and strongly nailed to it. The boat is now beginning to take shape (C, Fig. 4). Next a board, 2′ × 1′ (H, Fig. 6), must be nailed across the top at the stern, being secured both to the sides and the ends. The boat being now turned over, the bottom can be proceeded with. This is accomplished by nailing pieces of grooved and tongued inch board from side to side. It is not necessary to cut these to size first, because as the sides are safely braced together by the pieces to which they are nailed, it is not likely the application of the bottom will cause them to deviate. The bottom boards, therefore, of inch stuff, and any convenient width, may be firmly nailed on, and any surplus projecting ends can be sawn off.

When this has been accomplished, the joints require to be caulked. Oakum and pitch are the materials required; also a mallet and caulking iron. The orthodox form of these articles is shown at Fig. 5, where A is a ship-builder's caulking hammer and B the iron, or a piece of hard oak may dressed up to this shape, but the edge left broader, so that a greater length may be caulked at each stroke; but an ordinary light carpenter's mallet will do for the amateur for the former, and a fine-edged "cold" chisel, of about 6″ in length for the latter, C (Fig. 5). The oakum consists of fibres of old ropes torn asunder. The pitch must be melted in a pipkin over the fire, a little tallow having been added to it. Care must be taken that it does not catch fire, and to expedite the melting the pitch must be kept well stirred. When quite melted, a twig must be dipped in, and when drawn out with some of the pitch adhering, be plunged in cold water. Judge by the state of the small bead of pitch which clings to the end of the piece of twig. If it is brittle and easily broken, tallow must be added to the contents of the pipkin, and well stirred in. If, on the contrary, the drop is very soft and sticky, there is too great a proportion of tallow, and more pitch must be added to the mixture. By repeating the experiment the proper consistency will be obtained. The oakum must now be twisted up with the hands into a kind of loose coil, of the size the amateur judges he can force into the seams or joints to be caulked. This twisted oakum is then immersed in the hot pitch, and saturated therewith, and rapidly, neatly, and soundly driven well home in the crevices by the edge of the chisel, aided by smart, sharp blows of the hammer. The process requires a good deal of knack to do in a workmanlike way. When the pitched oakum seems inclined to adhere to the chisel, the edge of the latter must be dipped in some oil. In large seams it is sometimes necessary to go over with a second or even third paying of the pitched oakum. A thin coat of pitch may be brushed along the inside of the joints for further security. The seats are next to be adjusted. Two will be sufficient, one of which may be fixed about 3′ from the stern, and the other rather more than 4′ from the bow. The ends of the seats will require to be cut to the curvature of the side at the point selected for their positions. The seats are shown at D D (Fig. 6). They may be about 9″ wide, and 1″ stuff. For supporting the ends of the seats, two pieces of board, F F (Fig. 1), 1′ long, are screwed vertically to each side of the boat, with their ends resting on the bottom. On the upper extremities of these the ends of the seats rest, and are secured in that position by strong screws, G G (Fig. 1), which pass through the side planks of the boat and into the ends of the seats. Small pieces of stuff, about 1″ by ¼″, should be nailed across the boat under the seat, and beneath the seat across the bottom of the boat.

The stretcher or brace-piece originally nailed across the boat at D E (Figs. 1 and 2) may now be knocked off, and the craft is complete.

If rowlocks are required, they may either consist of cleats of hard wood firmly screwed on the inside of the boat, as at Fig. 6, or cut out of a couple of pieces of ash or other hard tough wood, to the ordinary shape of rowlocks and screwed on the side. Still another plan is to screw a piece of strong wood, perforated with a couple of holes on the inside top edge of each side. Into these

holes stout ash, oak, or hickory pegs about 5″ long, called "tholes," are inserted for the reception of the oars.

(To be continued.)

Hints From India.

BY W. L. D. O'GRADY.

COOLING SHADES.

During the very hot weather when President Garfield lay dying, a multitude of inventors pressed on his physicians various appliances for cooling the air of the sick chamber. Most of them were inefficient, and with few exceptions the rest were very expensive, too much so to be used in ordinary dwelling houses. Breweries have long had excellent apparatus for cooling the cellars, and some of our hospitals are equally well provided; but whether sick or well, the average resident of our cities has to submit to more or less stewing or baking during the heated term. We grumble, but do nothing to relieve ourselves, and soon cool weather comes and we forget all about the discomfort till we catch it again next year, and then we grumble again.

The inhabitants of countries where warm weather lasts longer than it does here use some very simple means to lower the temperature of their sitting-rooms. They not only keep them dark, which our proudest housekeepers do for another reason, namely, to save the carpets from fading, but use great fans, windsails, "thermantidotes," or windwheels driving air through cloths saturated with saltpetre, etc. The simplest plan of all is universal in India, where on the plains it is hot all the year round. There the *kuskus tattie*, or loosely woven mat of the fragrant fibrous roots of a shrub, is hung in one or more windows, the rest being carefully closed, and kept well wetted. The evaporation on even the calmest day soon sends down the thermometer inside the house, and the refreshing coolness is accompanied by a delightful perfume. In some parts of Italy and Spain coarse blankets are used, and if we cannot get *kuskus* here—and very little of it is imported, though it is very cheap and would surely be appreciated if better known—we might make ourselves much more comfortable by using wet blankets too.

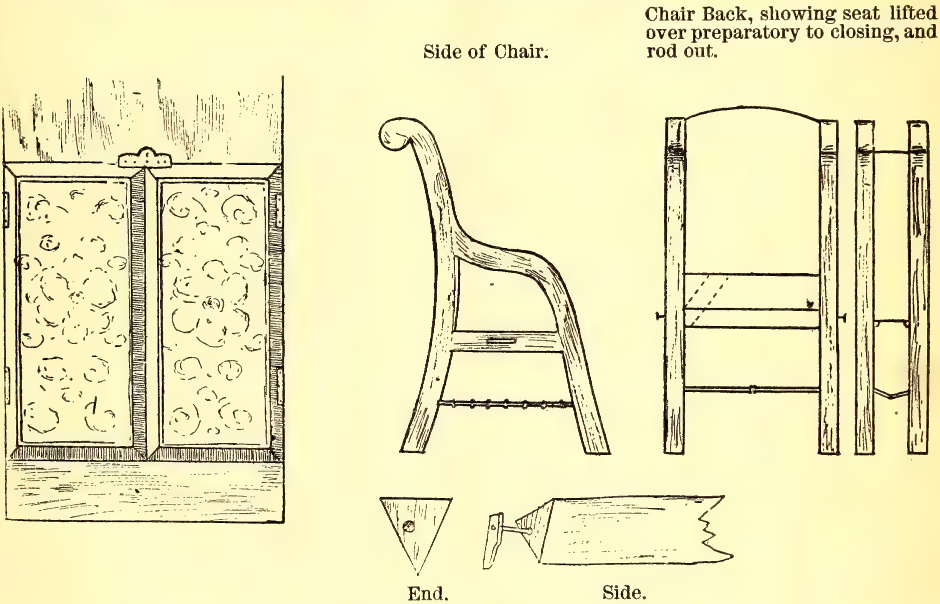
The great objection to this plan, if carried out as it is in India or elsewhere now, would be the trouble of keeping the affair properly wet, and besides, too free besprinkling with hose or watering pots would muss up the carpets. In India, where labor is very cheap, the trouble does not force itself on the attention of the people chiefly benefited, and as the floors are usually of hard cement like marble, if they are splashed it does not hurt them. There is an excellent arrangement, however, for automatically supplying the requisite amount of water for keeping the *kuskus tattie* sufficiently wet, and at the same time doing away with all possible inconvenience, which is cheap and easily applied.

A simple tin, zinc, or galvanized-iron trough is placed at the top of the *tattie* fastened to small brackets at the top of the window. It may be concealed by a lambrequin. The trough is triangular in section, the pins it works on being a little on one side. A cistern of some kind, enough to hold 24 hours supply of water, must be above the trough (unless a hose can be led to it and controlled as easily) with a small spout—a quill or tube of the same size of glass or metal would do admirably—and this should drip into the trough. When the water in the trough rises to nearly level with the balancing pins, the centre of gravity goes to the side and upsets the trough, which immediately recovers the original position when empty. It should upset every five minutes. The arrangement of this contrivance is worthy of the ingenuity of a smart boy, and the results are delightful. Dust and flies are excluded and the air is cooled. It is within the reach of the poorest.

A PORTABLE ARM-CHAIR.

Portable furniture is probably better appreciated in India than anywhere else. Officers there, as a rule, are moved about a great deal, to great distances and at intervals rarely exceeding three years, something after the Methodist discipline.

Perhaps, by the way, Wesley borrowed the idea from the East India Company. In consequence of this nomadic existence, families have the bulk of their furniture made to pack up in the smallest compass, while the very grand carved wood and marble adornments of the reception rooms go as regularly to the auction rooms as clockwork. The outgoers get somewhere near half of the value as an advance from the auctioneers, which comes in handy to meet incidental travelling expenses, and the new comers buy it at about the original price. But to return to portable furniture. Our ingenious people seem to turn out a wonderful variety of it, many of the things being attractive enough to enthuse an Anglo-Indian with bewildering delight. But neither here nor in India—till my example was followed by others—did I ever see anything that for solid comfort surpassed my portable arm-chair. When other people on the march were perched on camp stools and steamer chairs, I could take my meals with the righteous self-satisfaction of a man who has benefited himself and shown his fellow creatures how to be happy too. My arm-chair was, when fixed, so like the ordinary dining-room seat that it required considerable scrutiny to discover wherein it differed from it. When dismantled it occupied but a small space. The cane seat was hinged to one of the sides, being kept in place by an iron rod, and the back slid in grooves in the side frames. That was all there was to it. To pack it, the rod running through the sides and framework of the seat was pulled out, and the back slid out of its grooves and laid over the collapsed sides. Reversing the process produced a throne fit to bear the president of the Fat Men's Club. Of course, solid wood has to be used for a chair of this kind, no veneering being admissible, but if well made, and perhaps with some skilful carving on it, would be about as handsome a present as a bright boy could make to an indulgent father or grandfather; something decidedly useful as well as sure to excite admiration.



KUSKUS TATTIE, AND PORTABLE ARM-CHAIR.

— There is no dispute managed without passion, and yet there is scarce a dispute worth a passion.—*Sherlock.*

Chinese Foot-Rule.

A WRITER in the *North China Herald* gives some curious information respecting the foot measure in China. At present it varies largely in different parts of the country, and according to different trades; thus the foot of the carpenter's rule at Ningpo is less than ten, while that of the junk builders at Shanghai is nearly sixteen inches.

But a medium value of twelve inches is not uncommon. The standard foot of the Imperial Board of Works at Pekin, is twelve and a half inches.

A copper foot measure dated A.D. 81, is still preserved, and is nine and a half inches in length. The width is one inch.

The small copper coins, commonly called *cash*, were made of such a size, sometimes, as just to cover an inch on the foot-rule.

In the course of two centuries it was found that the foot had increased half an inch, and a difference in the dimensions of musical instruments resulted. Want of harmony was the consequence, and accordingly in A.D. 247, a new measure, exactly nine inches in length was made the standard. Among the means employed for comparing the old and new foot, are mentioned the gnomon of official sun-dials, and the length of certain jade tubes used according to old regulations as standards.

One of these latter was so adjusted, that an inch in breadth was equal to the breadth of ten millet seeds. A hundred millet seeds or ten inches, was the foot. The Chinese foot is really based on the human hands, as is the European foot upon the foot.

It strikes the Chinese as very incongruous when they hear that we measure cloth, wood-work, masonry, etc., which they regard as especially matters for the hand, by the foot.

Of the jade tubes above mentioned, there were twelve, and these formed the basis for the measurement of liquids and solids, four thousand years ago. They are mentioned in the oldest Chinese documents with the astrolabe, the cycle of sixty years, and several of the oldest constellations. It is likely that they will be found to be an importation from Babylon, and in that case the Chinese foot is based on a Babylonian measure of a span, and should be nine inches in length.

Canaries: How to Keep and Breed Them.—III.

BY GORDON STABLES.

IN my last article I recommended the reader to get his cages all ready for his coming favorites before buying them, and to get only young, strong, healthy birds, if possible from a prize strain. These questions, then, naturally suggest themselves: Where shall I buy my cages? and where shall I procure my birds? and how much should they cost? Buy your cages, as I have already observed, at a respectable bird-cage maker's, such as will be recommended if you write to this journal for advice in the matter; a good breeding-cage for a single pair will not cost more than from $3.00 to $5.00, furnished. Or you may see cages advertised in any of the cheap "exchange" papers, only be very careful how you deal with strangers.

If you possess what the Scotch call "the bump of gumption," you will be able to buy a very good pair of canaries at a bird-dealers for about five or six dollars; but it would be better to obtain the assistance of some one who knows good birds, and can recommend a particular strain or breed to you. If you want high-class birds, the addresses of successful exhibitors can always be obtained by procuring a prize catalogue of any show of the kind. How are you to get this? Why, write to the secretary and enclose the price of the catalogue with a polite note of request.

Bird-seed ought to be got as pure and good as possible. See that it is free from dust; sift it well, and keep it in clean, dry jars or pickle-bottles. Sea-sand is the best to be put in the bottoms of the cages. The birds ought to have a liberal supply of it, and it should be clean. You can buy it at a grocer's. A little old lime, broken well up, may now and then be

scattered about the bottom of the cage as well as the sand.

Anything of the nature of a narcotic militates against the chances of life in parasites; it is a good plan, therefore, to hang a small bag of camphor in a corner of the cage nigh to the nest. It is as well, too, when the young birds are about half fledged, to give them a clean nest, destroying the lining of the old one, and putting the box aside for disinfection and cleansing.

The eggs take, as I have already told you, thirteen days to hatch; and when the birds are about thirteen days old, the mother thinks she would like to begin to prepare for another family. Give her, therefore, another nest and some nesting material, else it is possible that the hen may attempt to line her nest-pan with the feathers of her progeny. This is what fanciers call plucking the young. If she persists in helping herself to the feathers of her young, they must be placed in a small cage, secured against the breeding-cage in such a way that the parents can get through their heads and necks to feed them. Or the male bird may be turned in for a time with the young; he generally makes a very excellent nurse. But my intelligent young readers will naturally observe, that if the hen has begun to prepare for a new brood, the attendance and supervision of the male will be wanted in the breeding-cage. This is perfectly true, and the difficulty is got over in this way by breeders: they turn the male into the big cage with the hen night and morning for an hour, or less. As soon as the hen has laid her third egg, the male may be retained as nurse only until the day of hatching, by which time the former brood will be able to pick for themselves.

Remember, however, that it is not very often neccessary to remove the young birds from the parent cage until the new brood is actually born, or on the eve of being so. They are then to be turned into a cage by themselves, and the more roomy this is the better, for young birds need exercise.

(To be continued.)

An Arabic Celestial Globe of the Eleventh Century.

IN the philosophical cabinet of the Royal Institute of Florence, many of the instruments of Galileo and other students of astronomy and physics are preserved. Among them is an Arabic celestial globe, of which F. Menssi has published an interesting description. It has not been long in possession of the Institute, and no one suspected its antiquity until recently. The one which is in the Borgian Museum, at Velletri, which was described by Assemani, in 1790, and which dates from the year 1225, has hitherto been regarded as the oldest. There are two others of the same century, one of A.D. 1275, owned by the Royal Asiatic Society of London, and the other of A.D. 1289, in the Mathematical Saloon at Dresden. There are also two, one owned by the Royal Astronomical Society of London, and the other by the National Library of Paris, both of which are without date. Menssi's curiosity was first awakened by observing that the longitude of the stars showed that the globe must have been constructed about the year 1075. On closer examination, he found an Arabic inscription around the Antarctic Circle, which he submitted for translation to the learned Orientalist, Prof. F. Lasinio. He presented a note to the Society, in a meeting which was attended by the Emperor of Brazil, in which he stated that the inscriptions were in Cufir characters, and that the globe "was made by Ibrahim Ihn Said as-Sahli and his son Mohammed; the work was finished in Valenza, in the beginning of the month of Safor, in the year 473 of the Hegira (corresponding to the 22nd of July, 1080)." The diameter of the globe is 209 millimetres (8·23 inches). It is composed of two hemispheres of brass, soldered together, and it gives the arrangement of stars and constellations which was adopted by Ptolemy. Among the Southern constellations, the Cup (Cratern) which should have been placed between the second and third coils of the Hydra, is wanting; all the other constellations

are very well engraved. The positions of 1015 stars are given, and their magnitude is well marked, inasmuch as every point, which is engraved to give the precise position of a star, is the centre of a little circle, which diminishes in diameter from the first to the sixth magnitude. The two circles of the equator and the ecliptic, are divided by means of little lines into 360 degrees, every fifth degree being marked by Cufir numeral figures. The zero of the equator is at its intersection with the ecliptic, in the beginning of the sign Aries. Twelve great circles of declination, lightly engraved, divide the ecliptic into its twelve signs. Forty-seven constellations are represented, 21 of which are in the Northern Hemisphere, 12 in the Zodiac, and 14 in the Southern Hemisphere. A heart-shaped curved line incloses the six stars near Aquilla, which represent upon our celestial globes, the constellation of Antonious. This constellation and that of Berenice's Hair, were introduced by Tycho Brahe, in the 16th century. On this globe, as upon other Arabic globes, the figures face the observer instead of looking towards the centre of the sphere. Therefore the stars which are upon the right side of a constellation on our globes, are on the left on the Arabic globes, and *vice versa.*

The New Postal Notes.

THE new postal notes authorized by the last Congress have now come into use. They are put up in books, each book containing 500 postal note forms, with the address of the post-office printed on each note. The pages of the books are perforated, so that when the notes are torn out stubs remain to show the amounts for which they were issued. A note can be filled out by a postmaster for any amount not exceeding $4.99, at a cost to the sender of three cents for each note. The notes are made payable to "the bearer" and they can be used as fractional currency in any place to which they are sent. The notes are printed on pure linen bank-note paper of the best quality, chemically prepared in such a manner as not to be affected by moisture or exposure to light, while it is sensitive to the action of acids or other liquids often used by forgers. The color of the paper is a pure lemon, and the front surface is printed over with an underlying tint of golden brown. The water-marks in the paper, twisted in the form of a figure 8, have the words "U. S. Postal Note" in duplicate—reading from both left and right. Three printings are required to complete the note. In the underlying tint is a vignette consisting of a classical female head wearing a helmet. Much of the tint is made up of miniature photographic designs, containing the words "United States Postal Note" repeated many hundred times, and engraved so finely that one can read the words with the naked eye, while it would be difficult to make a counterfeit. Winged wheels, with a halo from behind, make up a portion of the tint. The back of the note is elaborate and is printed in a dark green. In the centre is the monogram "U. S." engraved with a geometrical lathe. The monogram is embedded in an intricate cycloidal lace work of white line cutting, the tracings for which were done also with the geometrical lathe.

These postal notes will be an immense convenience in sending small amounts of money, especially where it is desired to send a fractional part of a dollar. To get the money, the note is simply presented at the office on which it is drawn. Before presentation, however, the note must be signed by the person who presents it for payment, on the line where we have signed "*Industrial Publication Co.*" They will be good for three months from the last day of the month in which they are issued. A diagram of the new note is given herewith. A person living in Boston, for instance, and desiring to send any sum below $5, say three dollars and sixty-four cents, to any one in New York, goes to the post-office and deposits the same with a fee of 3 cents. The postmaster will then punch three holes as indicated, to the right of the order, showing the dimes or cents deposited, and dollars if so much, two more holes to the left through month and year.

He will then affix his stamp and signature, and hand over the note without further trouble.

Boston, Mass.
No. 1462.
Amount, $3.64.
Date of issue, October, 1883.
Office drawn upon:
NEW YORK,
N. Y.

Jan.	0
Feb.	1884.
Mar.	1885.
Apr.	1886.
May	1887.
June	1888.
July	1889.
Aug.	1890.
Sept.	1891.
0	1892.
Nov.	1893.
Dec.	1894.

PLACE FOR POSTAL STAMP.
WHERE OBTAINED.

FEE
Vignette.
THREE CENTS.

DATED STAMP OF PAYING OFFICE.

Boston, Mass. No. 1462.

POSTAL NOTE.

For Sums Less than Five Dollars. Payable in the United States only.

To the POSTMASTER of the MONEY-ORDER OFFICE at
New York, N. Y.

Pay to BEARER, at any time within three months from the last day of the month of issue, the sum of *Three* dollars 64 cents.

.... *Postmaster.*

This postal note is also payable to bearer at the office of issue, with the same limitation as to time. If lost or destroyed, no duplicate thereof can be issued.

RECEIVED the above named sum.

Industrial Publication Co.,
Signature.

Dol's	Dimes	Cents
1	1	1
2	2	2
0	3	3
4	4	0
0	5	5
	0	6
	7	7
	8	8
	9	9
	0	0
Hds.	Ters.	Units.

Modern Giants.—Some of the Mighty Men and Women of Late Years.

SAMUEL McDONALD, a Scotchman, nick-named "Big Sam," was six feet ten inches in height. Was footman to Prince of Wales. Died 1802.

Alice Gordon, Essex, England, giantess, seven feet. Died 1737.

Anne Hanen Swan, of Nova Scotia, seven feet.

La Pierre, of Stratgard, in Denmark, was seven feet one inch.

Henry Blacker, seven feet four inches, and most symmetrical. Born at Cuckfield, in Sussex, in 1724. Generally called the "British Giant." Was exhibited in London in 1751.

Howard Hamford, seven feet four inches. Died 1768. Buried in St. Dunstan's churchyard, London.

Louis Frenz, Frenchman, seven feet four inches. His left hand is preserved in the museum of the College of Surgeons, London.

Martin Saleron, a Mexican, seven feet four inches.

Porus, an Indian king, who fought against Alexander near the river Hydaspes, B.C. 327, was seven and a half feet high, with strength in proportion.

Heinrich Osen, born in Norway, seven feet six inches: weight, 300 pounds, or fifteen stone.

Edward Melon, seven feet six inches. Born at Port Leicester, Ireland, 1665, and died 1684, being only nineteen years of age.

James McDonald seven feet six inches. Native of Cork, Ireland. Died 1760.

Robert Hale, seven feet six inches. Born at Somerton, England, in 1820, and often called the "Norfolk Giant." Died 1862.

Francis Sheridan, an Irishman, seven feet eight inches; weight, twenty-two stone; girth of chest, fifty-eight inches. Died 1870.

Bradley, seven feet eight inches at death. Born at Market Wheaton, in Yorkshire, England. His righ hand is preserved in the Museum of the College of Surgeons. 1798–1820.

Joseph Rice, seven feet eight inches. At the age of twenty-six years he was exhibited in London, 1862–5. His hand could span fifteen and a half inches. Born at Ramonchamp, in the Vosges, France, 1840. Was sometimes called Anak.

Cornelius Magrath, seven feet eight inches. He was an orphan and reared by Bishop Berkeley, England. Died at the age of twenty years. 1740–1760.

John Busby, of Darfield, seven feet nine inches. His brother was about the same height.

Joachim Eleozogue, Spanish giant,

seven feet ten inches. Exhibited in London.

Captain Bates, of Kentucky, seven feet eleven and one-half inches. Exhibited in London, 1871, New York, 1880.

Harold Hardradra, Norwegian giant, nearly eight feet.

Gilly, a Swede, eight feet. Exhibited at a show early in the nineteenth century.

William Evans, eight feet at death. Porter to Charles I. Died 1632.

Charlemagne, nearly eight feet. He could squeeze together three horse-shoes at once in his hands.

J. Toller, of Nova Scotia, eight feet. Died 1819.

Maximilian Christopher Miller, eight feet. His hand measured twelve inches and his forefinger was nine inches long. Called the "Saxon Giant." Died in London. 1674–1734.

Chang-woo-goo, of Tychou, Chinese giant eight feet two inches. Exhibited in London and New York, 1866–67 and again in 1880.

J. H. Reichart, of Friedburg, Sweden, eight feet three inches. His father and mother were giants.

Charles O'Brien, of Byrne, Irish giant, eight feet four inches. His skeleton is preserved in the Museum of the College of Surgeons. 1761–1873. Patrick, his brother, was eight feet seven inches.

Loushkin, Russian giant, eight feet seven inches; drum-major of the Imperial Guards.

Maximinus, eight feet six inches. The Roman Emperor, 235–238.

A human skeleton eight feet six inches, is preserved in the museum of Trinity College, Dublin.

What's in a Name?

WHO that has ever examined the blossoms of the potato has not pronounced them beautiful, and many of the new varieties of the potato are very fine. We remember well long years ago, some forty years, when we were importing and testing new species of the potatoes from other States, we carefully planted some eight or ten varieties for a test of their value, and when they were in bloom we gathered many clusters of the new kinds and exhibited them in our stand at the Horticultural Society of Boston, Mass., labelling the entire exhibit as the Blooms of *Solanum Tuberosum*, and as these blossoms were in very handsome clusters our stand attracted quite a crowd, and we heard many young ladies asking their friends:

"Have you seen that stand of new and beautiful flowers exhibited by Mr. Warren?"

For an hour quite a bevy of ladies gathered to see these new flowers of the *Solanum*. After they had been much admired and praised, we took an opportunity to change the label, placing in its stead these words—THE POTATO BLOSSOMS, and we heard often these exclamations—

"Why! is it possible, after all, these were *only* the *Potato* blossoms?"

And thus it is, many of the best blessings of life are greatly undervalued because they are common.—*California Farmer.*

Our Girl's Department.

This department is intended exclusively for "Our Girls," and we hope to make it both interesting and instructive, and to this end we ask our young lady readers to assist by contributions, suggestions, or illustrations. There are thousands of little things that can be, and have been, made and done by young ladies, pertaining to decorative art, needlework, etc., etc., that would be gladly followed but for a want of knowledge on the subject, and we know of no more pleasing task for a lady than that of teaching her younger sisters that which they are anxious to learn, and which may prove of real benefit to them in the future, as well as being useful and interesting for the present. We trust we will have no difficulty in persuading those who have something nice to show or speak of, to make use of this department. Remember, it is open to all, and if you have anything worth knowing suitable for this column, send it along, and we will give it our best attention. Do not be afraid to write because you may fancy your composition is not perfect, or have other scruples of a similar kind. Do the best you can, and leave the rest to the editor of this department, and we are sure you will be pleased with your work.

—Girl in hammock
  Reading book
Catches man
  By hook or crook.
Girl in kitchen
  Scrubbing pan,
Cannot gobble
  Any man.
Ten years later,
  Head in whirl;
Man wishes he'd taken
  Kitchen girl.

— Anger is like rain, it breaks itself upon that on which it falls.—*Pope.*

— If you would not have affliction visit you twice, listen at once to what it teaches.—*Burgh.*

— Fire and sword are but slow engines of destruction in comparison with the babbler.—*Steele.*

— He who receives a good turn should never forget it; he who does one, should never remember it.—*Chanon.*

— The actions of men are like the index of a book; they point out what is most remarkable in them.—*Addison.*

— Ambition often puts men upon doing the meanest offices; so climbing is performed in the same posture with creeping.—*Swift.*

— No man can possibly improve in any company for which he has not respect enough to be under some degree of restraint.—*Chesterfield.*

— An unjust accusation is like a barbed arrow, which must be drawn backward with horrible anguish, or else will be your destruction.—*Taylor.*

— If a man empties his purse into his head, no man can take it away from him. An investment in knowledge always pays the best interest.—*Franklin.*

— Whatever difference there may appear to be in men's fortunes, there is still a certain compensation of good and ill in all that makes them equal.—*Chanon.*

— Of all the vanities and fopperies the vanity of high birth is the greatest. True nobility is derived from virtue, not from birth. Titles, indeed, may be purchased, but virtue is the only coin that makes the bargain valid.—*Burton.*

— Adversity exasperates fools, dejects cowards, draws out the faculties of the wise and industrious, puts the modest to the necessity of trying their skill, awes the opulent, and makes the idle industrious.—*Coleridge.*

— Envy's memory is nothing but a row of hooks to hang up grudges on. Some people's sensibility is a mere bundle of aversions, and you hear them display and parade it, not in recounting the things they are attached to, but in telling you how many things and persons they cannot bear.—*John Foster.*

— Such is the encouragement given to flattery in the present times that it is made to sit in the parlor, while honesty is turned out of doors. Flattery is never so agreeable as to our blind side; commend a fool for his wit or a knave for his honesty, and they will receive you into their bosom.—*Fielding.*

— Dr. H. F. Hamilton says that at least once a day girls should have their halters taken off, the bars let down, and be turned loose like young colts. "Calisthenics may be very genteel, and romping very ungenteel, but one is a shadow, the other the substance of healthful exercise."

— Anxiety is the poison of life, the sure destroyer of health, the parent of many sins and of more miseries. Why then allow it, when we know that all the future is guided by a Father's hand.

— A tidy called a "chair back," can be made by getting one yard of Aida canvas; fringe each end by taking six strands and making into a knot with a crochet needle. The next row must be made by taking three strands from each previous knot and making a knot in the centre of the others. A handsome border must be worked on each side in cross-stitch embroidery. Do not buy your pattern too elaborate, or the work will be tedious. In selecting your pattern be sure to get one requiring bright colors, such as bright blues, reds, bronzes, greens and pretty browns.

— Girl graduates in England wear gowns precisely like those worn by university men, and made by the same tailor. At present they have only donned the B.A., or bachelor of art, robe, which is black and brown, and the B.Sc., or bachelor of science, which is yellow and black, but no doubt in time they will attain to those of higher degrees. The long black silk gowns, which are all of the same pattern, with large cape-like

sleeves gathered into the shoulder, the skirts full and flowing, were worn over ordinary short black dresses, with lace or crepe lisse frills appearing above them at the throat. The ladies, rich in academical honors, wore white gloves, and carried the square white college caps in their hands.

— A San Francisco young woman has started a new business. She goes about from house to house mending jewelry and repairing clocks. When she has to drill a hole in a piece of metal she has drills and a lathe which she works by attaching to a sewing machine. Almost everybody who has jewelry has also a sewing machine. Her trade flourishes. Most ladies have bits of broken jewelry lying about which they do not think it worth while to send to a shop, but which they would gladly have mended should any one come to the house and fix it up at a small price. In the regulating of clocks also she does well. Besides her lathe and drill she has with her, in a neat little box, a full kit of jeweller's tools, a spirit lamp, and blowpipe.

— As a natural sequence to the restraint under which Cuban lovers are held, there are a great many small intrigues and innocent endeavors to circumvent the detectives. There are eloquent glances, signals, fun-talk, and the sly interchange of notes. Then the iron-guarded window, instead of being a protection, becomes a great convenience. It is more than the front gate with us. She knows when he will pass by, and stands inside with a fair hand clasping the bars of her cage and waits for him. They stand there with the iron between them and talk. Every day it is so, and if mamma wishes to stop it she must come and stand in the window also. There are other respects in which the young man has a hard time. He must come every day. He *must*, and she holds him to the strict letter of this law. He is bound to show, by every means in his power, that he holds all other women in contempt and detestation. He must not dance with any other, and had better not be caught holding on to any other window bars in any other street. He tells his near friends about it, and she all hers, and the matter is diligently discussed. If he should fail to come around regularly every day he has to tell a satisfactory story. I have known her to send her brother after him. He takes his revenge after marriage.

— "Do you beat brass?" is the initial catechism of the latest fashionable handicraft in Philadelphia. It is a particular pet with feminine fingers, and requires a thorough and practical knowledge of hammers and tracing tools, brass, and block. A class of ladies, under the patronage of the Scandinavian Thor, have produced some beautiful and lasting work. The instructor teaches them the way of using and holding their tools, and the proper kind of stroke to make upon the steel dies. The method is simple. On a block of wood a brass plate or sheet is fastened. The design is then drawn upon it; the outline hammered by a die, which has a row of dots. Other dies give the groundwork a frosted or mottled appearance. Everything depends on the skill of the workwoman. Really valuable articles in *repousse* brass can be made from a piece of brass costing but a small sum. Card-receivers, plaques, and many other things, can be made. The brass-beating educates the hands and develops the muscles. It is worthy of note how much interest in the mechanical arts is publicly shown, sometimes the hammering of brass is combined with the use of the paint-brush. A brass tray lately seen has a loose spray of purple pansies, apparently flung down carelessly upon it.—*Philadelphia Ledger.*

BEAUTY.—III.

Cosmetics and paints, too, are much used, especially in England. They are as fatal to health and beauty, as they are misleading in effect. The blackened eye may look larger, and the painted lip redder under the uncertain flare of the gas lamp; but, when seen at home in the broad and honest noonday sun, the eye is lustreless. The flaming carmine distorts the mouth, the powdered

skin loses its transparency, and the soft brown hair which formerly enhanced the whiteness of the skin, now appears a lifeless yellow or mahogany red, without light or shade in it. The very men who pretend to admire these artificial dolls, would hesitate to choose their wives from their ranks. Thus once more verifying the old dictum, that "a thing may look well in a shop window, and yet not be adapted for house wear and tear."

There are a few powders that are good for the skin. But many of those purchased at the druggist's contain lead and other poisons. They are done up in elegant wrappers, and look very inviting in the glass cases of the apothecary; but, beware of them, nearly all thicken and roughen the skin.

The Roman ladies used the fine dust of calcined shells for a toilet powder, and the juices of plants to restore their freshness of color. The girls of to-day use to some extent crushed geranium leaves, the juice of strawberries, friction with red flannel, and many other homely substitutes for rouge.

If you will only take plenty of exercise, freely use pure water and soap, and eat wholesome food, avoiding pastry, you will have no need to resort to artificial color.

Violet or baby's powder is one of the best powders as it contains neither lead nor bismuth, and is quite harmless, and looks better than the greasy or shiny appearance that so many have. If used properly it cannot be detected. A layer of powder will prevent freckles and sunburn. It cools feverish skins, and is excellent for prickly heat and summer rashes caused by heat. The skin should be washed before using. Then take a little of the powder and put it in a coarse linen cloth, wash the face quickly with the linen, and the wet powder oozes in its finest state through the cloth, leaving a white deposit when dry. Press the face lightly with a damp cloth, to remove superflous powder.

This mode of using powder, is less easily detected than when it is dusted on dry.

The finest arrowroot scented with orris-root is also good and harmless. The rice powder prepared by Lubin, is very finely ground rice meal, scented with ottar of roses. Of powders made from metallic substances, the best is precipitated carbonate of zinc. It is harmless, and if moderately used, beneficial to the skin. It is a favorite application in skin diseases, and where parts are chafed, or have slight eruptions, its use will be found healing as well as beautifying. With an equal amount of French chalk, it forms a powder highly extolled by some excellent authorities.

If the ambition of beauty would stop here, there would be no complaint to make. But no! a more decided color is wanted—a tint more brilliant than nature herself ever grants. To obtain this, recourse is had to those unwholesome metals, lead and mercury. Those in the form of carbonate of lead, or flake white, and the mercurial white precipitate, are vended for the purpose. They are certain to destroy health, as well as beauty. Moreover, when used, they give a hue so brilliant, that any observer can see at a glance that it is unnatural.

Therefore, from a cosmetic as well as hygienic point of view, they should be abolished, for the perfection of art is to achieve a perfect resemblance to nature at her best, not to surpass her, or fall behind her.

Rose-powders, or flesh colored powders, are prepared from any of the powders mentioned by adding to them a little carmine until the desired tint is obtained.

The most popular and easiest way to imitate the glow of youth on the cheek and lips, is "*to* rouge."

The word rouge in French simply means red, and is applied to many products having this color. That which is put up and sold for the complexion, is generally, and should always be derived from one of two sources: either from cochineal, a small bug found on the leaves of the cactus plant of Brazil, which yields carmine, or from the plant known as "dyer's saffron."

The preparation of rouge is one of the

most delicate operations in practical chemistry, and few beside the French have succeeded in producing a first-class article. A London manufacturer once learned to his cost, that more than mere technical skill was required to produce it. He had tried repeatedly to equal the French article, and failed just as often.

In despair he visited one of the most famous houses in Lyons, and offered the principal thirty thousand francs if he would show him their process. The principal accepted, and conducted the Englishman through the establishment. What was the disappointment of the latter to find the methods in every way identical with his own. He returned home, tried again, and failed. The principal of the Lyons house invited him once more, and put the questions: What was the state of the weather when you made the experiment? "The weather!" replied the Englishman, "the weather! I dont remember. What has that to do with it?" "Everything" replied the principal. "It is only on the fairest days in this favored climate we can make our carmine."

"If that's your secret," said the visitor, "I had better have kept my thirty thousand francs, as it will do me little good in the London fogs."

When the inventive genius has in so many ways prepared materials for whitening, and again for reddening the skin, there still remained the blue lines of the veins, which course beneath the skin, and unless something was found to include these in the "make up," the art was sadly at fault.

It has been done. The elegant world can now provide itself with little jars of Venetian or French chalk, made into a paste with gum water, colored to the proper tint with Prussian blue, and accompanied with little leather pencils, all manufactured on purpose to portray the direction and hue of the veins; this should be done very delicately, and if possible by a cosmetic "artist."

Pallor is associated with sickness and debility, which are not akin to personal beauty. It is just as easy for the skin to be too white, as too red or too brown. Some are troubled with this paleness from childhood, in others it is the result of failing health; in both cases the blood is at fault.

It demands more carbon to form pigment; more iron to build up the system, and color or enrich the blood. Strange as it may seem, it is these familiar and homely substances, charcoal and iron, which the magic wand of nature transforms into delicate dyes, and spreads out on the skin a healthy glow.

It is not enough to take just such things to introduce into the system these indispensable materials in the form best adapted to be readily taken up by the blood. This, indeed, is essential, but beyond this, the surface of the body must be stimulated by regular exercise and friction. To sum up in a few words the prescription for those who, without suffering from any disease, and have a colorless skin, pale lips, and a general want of red blood: A diet, or tonic, or both well supplied with carbon and iron, a lukewarm bath every morning, followed by friction with a rough towel, active exercise in sun and air, and the avoidance of alkaline and astringent soaps and washes.

Beside the friction mentioned as a stimulant to the skin, there is another resource—electricity. Its value as a cosmetic is very great. Any friction that disturbs the electrical condition of the skin, and produces a flush, is good. If the battery is used, brushes made for the purpose are passed rapidly over the surface, causing a not unpleasant tickling sensation, and bringing the blood to the minute vessels with marked force. That method which is called "general electrization," is especially applicable to such cases as described.

Even those faces pitted by the dread disease small-pox, can always be improved, and some greatly so. For this purpose, strong stimulating lotions are employed several times a day, alternated with gentle and long-continued inunction of oil or glycerine. In many cases, by steady perseverance in such applications, very great improvement has resulted.

M. W.

THE

Young Scientist.

A Practical Journal for Amateurs.

(With which are incorporated "THE TECHNOLOGIST," "THE INDUSTRIAL MONTHLY," and "HOME ARTS.")

PUBLISHED MONTHLY AT $1.00 *PER YEAR.*

EDITORS.

JOHN PHIN. FRED. T. HODGSON.

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The YOUNG SCIENTIST may now be said to be a fixed fact, or, to use an expression more emphatic than elegant: "It has come to stay." The success of the past years is an evidence of the sagacity of the publishers in seeing and providing for the scientific and mechanical instincts of American youth of both sexes; and, although it has been somewhat difficult to displace, even in a small degree, the baneful and blood-curdling literature, that so plentifully floods the country wherever a youth is to be found, the YOUNG SCIENTIST has forced its way mainly on its own merits into many places where the "blood and thunder" influences once reigned supreme. It is quite true, that without the aid of many of the best families in the land, we should never have been able to hold our own as well as we have done against the fearful odds we battle with; and to those parents and guardians who have stood by us in the fight, we offer our hearty thanks, and trust that our future efforts may be so directed as to still further warrant their substantial appreciation. We will shortly be prepared to furnish full sets of the YOUNG SCIENTIST, beginning with Vol. I, to Vol. VI, making, with the present year, six useful and handsome volumes, admirably suited for holiday gifts either to boys or girls. Next month we shall be in a position to announce when the volumes will be ready, and the price for single ones, or full sets.

As the time is at hand for renewal of subscriptions for the coming year, we feel that we can depend on our friends for a little extra assistance in the way of obtaining new readers, and by so doing, enable us to give them a better and larger paper in the years to come. Every new subscriber added to our already good-sized list, gives us so much more strength, and weakens the common enemy materially. Therefore, we offer no apology whatever for asking our friends to speak a good word for us when opportunity occurs.

To our younger readers we would say, that we are willing to reward their efforts in increasing our circulation by paying them for results in books or otherwise. To those who prefer it, we will send the YOUNG SCIENTIST free, to any one who will send us two new names and two dollars; thus, giving three subscriptions for two dollars.

Where our readers prefer it, we will allow cash commission of twenty cents for every new name obtained. That is, for every new name, remit us eighty cents and retain the twenty for your trouble. This offer, however, will only hold good until January the first 1884.

Boys and girls, to be healthy and happy, must have some useful services to perform. Toil and action are the prices paid for sleep and rest. Laziness begets misery, melancholy, and sickness. Every living thing must work; this is necessary for its existence and enjoyment. The wild beast caged up will roam and wander round its narrow limits, until tired, when it sleeps, and doubtless dreams of the days it was free. Work is a privilege, and one we all should value; therefore we should never refuse to do anything our parents, guardians, or teachers ask of us. They will not ask of us anything unreasonable. Work, boys and girls, fairly and willingly done, will bring you more happiness and genuine healthy joy than

almost anything else in this world. Remember how the little "busy bee gathers honey all the day;" and don't forget what you all have read in the book of Proverbs, where the lazy man is told to "Go to the ant, thou sluggard." To do nothing is to go backwards; something that can not be tolerated in this world. All our wisest and greatest men and women were once industrious and active boys and girls.

Before these lines reach our readers, the public schools throughout the length and breadth of the United States will have been thrown open to receive their precious students, many of whom will become the history makers of the next half century. Every morning now, for many months, thousands of boys and girls will be seen, not as Shakespeare puts it, creeping unwillingly to school, but tripping thither in good heart and with cheerful faces. In Shakespeare's day schools were not what they are now, or he would not have written so disparagingly of the schoolboy. In that age birches were used very extensively, and the pupil's head was cultivated at the expense of their personal comfort. We have improved upon that. We have spoiled the rod and spared the child, and the consequence is that the discipline of benevolence and intelligence has been found to be more effective than the flagellation practiced under the old regime. Our schools and teachers are improving, with occasional lapses, and so are our scholars. These things being so the beginning of the present term was hailed with pleasure, rather than dread and fear.

Athletic Notes.

Base-Ball.

New York vs. Staten Island.—The contest at Staten Island September 5th between the New York professionals and the Staten Island nine proved to be a one-sided contest, in which the professionals won with ease by a score of 10 to 1. O'Neil and Humphries pitched and caught for the New Yorks, and not a run was earned off the former's delivery, the run obtained being scored by errors, the fielding on both sides in the early part of the contest being interfered with by a gale of wind which blew across the field. The pitching and catching of Tyng and Shaw were very good in a majority of the innings. Walden bore off the palm in the field, he accepting eight out of nine chances at second base.

The Metropolitans of New York have played 48 championship games on the Polo Grounds this season, of which they won 30, lost 17, and had one drawn. Of the defeats sustained on the home-field, six were with the St. Louis nine, four with the Eclipse, three with the Athletic, two with the Allegheny, and one each with the Cincinnati and Columbus teams, the Baltimores not scoring a single victory on the Polo Grounds. The Metropolitan victories were six each with the Cincinnati, Columbus and Baltimore teams, five with the Allegheny, four with the Athletics, two with the Eclipse, and one with the St. Louis, their drawn contest being with the Eclipse. The Metropolitans left town for the West Sept. 7.

Swimming and Yachting.

— A sister of Captain Webb is reported by cable to have been found drowned in the river at Ladysmith, Natal. She became insane upon hearing of the death of her brother.

— A movement is on foot to erect a monument to Captain Webb, the swimmer, on the spot on the Severn River where he once saved a life.

— The contest for the amateur swimming championship of England at five hundred yards took place on the evening of Aug. 21 at the Lambeth Baths, London, under the auspices of the North London S. C. First heat: W. R. Itter, Torpedo S. C., first, in 8m. 8s.; W. Henry second, by thirteen yards; A. E. France third. Second heat: E. C. Danels, North London S. C., first; J. Brogan second, by two yards; G. Dunmore third, by a dozen yards. Final heat: Danels first, in 7m. 48¼s.; Itter second, by fifteen yards;

Henry third, by seven yards; Brogan fourth, by six feet.

— The annual swimming contests for the championship of the New York Athletic Club took place on the Harlem River Sept. 8. The one-hundred-yards event was swum across the stream, from the club-house, and was won by H. E. Toussaint in 1m. 35s.; J. B. Moore second, by a yard; H. B. Phinney third, Sidney Green fourth. The half-mile race was down-stream, with the tide, but the contestants had the strong south-west wind against them. C. T. Schlesinger led all the way, and won in 12m. 23¼s.; H. E. Toussaint second, by five yards; Theodore Guierra third, and A. L. Esterbrook fourth.

— Dr. Bryant having shown that the Shadow can beat the Wave of the New York Yacht Club, an effort is being made to match her against the Fanita, owned by George J. Gould, of New York.

— The American Yacht Club have taken a two years' lease of a portion of the apartment-building on the northwest corner of Madison avenue and Twenty-eighth street, New York City, and it is expected that the rooms will be ready for occupancy Oct. 1.

— Hanlan, the champion sculler, will, it is stated, establish a ferry of his own between Toronto and the island on which his hotel is located. This does not lend color to the rumor that he contemplated removing from Canada because his liquor license was revoked.

— The September meeting of the Dorchester (Mass.) Yacht Club was held Friday evening, Sept. 7, at the club-house, at Harrison square. The treasurer reported a balance of $259.18. On account of the closing of the Hotel Pemberton the matter of a supper was laid over.

— The annual regatta of the Oswego Yacht Club was sailed on Lake Ontario Aug. 28. Five yachts competed, and Capt. Cuthbert's Katie Gray, 10 tons, won, defeating the Ella (19 tons), Cricket (10), Laura (11), and Fairwater (12).

— The sloop-yachts Gracie and Fanny, both belonging to the New York Yacht Club, are matched to sail a race off Sandy Hook on Oct. 8. The race will be sailed under the time-allowance given at the last regatta of the N. Y. Y. C.

— The Quincy Yacht Club held their closing regatta for this season over a course off Great Head, Mass., Sept. 8. First and second prizes (cash) were given in each class, and the result was as follows: Second class—J. F. Brown's Niobe first, in 1h. 31m. 5s. actual sailing time and 1h. 3m. 27s. corrected time; J. R. Putnam's David Crockett second, 1h. 31m. and 1h. 4m. 33s. Third class—D. H. Lincoln's Flora Lee first, 1h. 17m. and 51m. 17s.; S. G. King's Samaria second, 1h. 19m. 25s. and 54m. 13s.

— The Cape Ann Yacht Club sailed their open regatta, for small boats, postponed from the preceding day, at Gloucester, Mass., on Sept. 1. A fairly good breeze came from the northeast, and the weather was bright and bracing on the water. There were eight starters in the first class, for yachts over 20 ft.; fourteen in the second, over 15 ft.; and six in the third, under 15 ft. Three cash prizes were offered in each class, which were won as follows: First class, 12 miles—Cunningham's Kittiwake first, in 3h. 48m. 9s. actual and 3h. 2m. 39s. corrected time; McKenzie's Venus second, 3h. 49m. 55s. and 3h. 9m. 23s.; Pigeon's Judith third, 4h. 2m. 48s. and 3h. 21m. 10s. Second class, 6 miles—Griffin's Sassacus first, 1h. 25m. 25s. and 58m. 34s.; Tucker's Sunbeam second, 1h. 33m. 24s. and 1h. 5m. 8s.; Holder's Helen third, 1h. 30m. 37s. and 1h. 6m. 10s. Third class, 6 miles—Williams' Marchioness first, 1h. 45m. and 1h. 13m. 54s.; Bickford's Tit second, 1h. 56m. 57s. and 1h. 24m. 3s. Judges—H. F. Sanford, George H. Oakes and G. H. Blatchford.

— The annual regatta of the Union Boat Club was held on the Harlem River on Saturday, Sept. 8. The weather was cloudy and threatening, and a stiff breeze from the southwest roughened the water considerably. The distance rowed in all the races was one mile, straightaway, and the results were as follows:

Pair-oared gigs.—S. Van Zandt, O. J.

Stephens, J. J. McGeer (coxswain), first, in 8m. 14s.; O. Berger, V. R. Roby, J. T. Harden (coxswain), second by several open lengths; D. W. Edwards, A. Waengler, L. Walter (coxswain), beaten off.

Senior single-sculls.—J. R. Pettit first, in 8m. 55s.; Max B. Kaesche second, by more than a length; P. J. Engel and James Gallagher did not finish. The winner was in front from the start.

Junior single-sculls.—L. Walter first, in 8m. 23s.; Floyd Grant second; W. H. Connell, 0; W. D. Kelley, 0; T. A. Fitzsimmons, 0. At the first attempt a foul occurred between Kelley and Grant, causing a fresh start. A steam-launch interfered with Connell, and Kelley met with a mishap by the breaking of his footstrap.

Four-oared gigs.—J. R. Pettit (bow), O. J. Stephens, W. D. Kelley, S. Van Zandt (stroke), J. J. McGeer (coxswain), first; P. J. Engel (bow), William Schulet, Oscar Berger, Max B. Kaesche (stroke), A. J. Maehler (coxswain), second.

Six-oared gigs.—Bachelors: V. R. Roby (bow), William Schuler, O. J. Stephens, William Lalor, L. Walter, Max B. Kaesche (stroke), John T. Harden (coxswain), first, in 7m. 6s.; Benedicts: P. J. Engel (bow), F. Grant, J. W. Goodsill, Jas. McCartney, Oscar Berger, A. Schneider (stroke), A. J. Maehler (coxswain), second, by two lengths.

Eight-oared shells.—James Gallagher (bow), Joseph Halk, L. Shaffner, T. A. Fitzsimmons, J. R. Pettit, V. R. Roby, William Schuler, Max B. Kaesche (stroke), John T. Harden (coxswain), first, in 6m. 32s.; E. J. Connell (bow), D. McGin, J. C. Martin, G. W. Koehler, F. Grant, L. Walter, Oscar Berger, Wm. Lalor (stroke), D. W. Edwards (coxswain), second, by a few feet.

Odd Notes.

— The largest black bass known to have been caught in Greenwood Lake is stated to have been landed a few days ago by Andrew Dickinson. It weighed a little more than eight pounds.

— About two thousand persons were at the Nantasket Skating-rink, Mass., Sept. 1, to witness a game of roller-polo between the Boston and Nantasket Clubs. The latter team won the first goal after playing seven minutes, and, as the half-hour limit expired before another was gained, the Nantaskets carried the day.

— The thirtieth anniversary of the birth of the Pottsville Fishing Party, a social organization composed of prominent men, was on Aug. 30 appropriately celebrated at the People's Railway Park, Pottsville, Pa.

— At a meeting on Sept. 6 of the committee appointed by the National Rod and Reel Association to make arrangements for the tournament to be held Oct. 16 and 17, different committees were appointed and an amateur fisherman was defined to be one "who has never fished for a living, has never been a guide, and has never been employed in the sale or manufacture of fishing tackle."

— A meeting of the National Rifle Association was held Sept. 4, at which it was announced that sufficient funds had already been guaranteed to enable an English team to come to this country next Summer. A committee of five will be appointed by the N. R. A. to prepare for the match.

— The first annual picnic of the Boston (Mass.) Homing Pigeon Club was held Sept. 4. The entertainment consisted of dancing and the liberation of several coops of thoroughbred birds which were on exhibition. Sixteen birds were sent to Cambridgeport, eight to Dedham, fifteen to Lowell, seven to Stoneham, twelve to Waltham, twenty to City Point, fifteen to South Boston, and nine to Jamaica Plain—102 in all. The fourteen birds that made the 800 miles' journey from Canada were on exhibition and attracted much attention.

Correspondence.

Ed. Young Scientist—Dear Sir: I would beg leave to call your attention to the fact that here on the Boise River is a place where flowers in abundance furnish food for an unlimited number of bees. I have been up on the South Fork of the Boise River, where no one yet has ven-

tured to settle, and found in May, June and July the greatest abundance of honey flowers growing in vast quantities. The main flower belongs to the *Syringa Philadelphus*, if I am right, a single white flower growing on a shrub from six to twelve feet high, and covered with these white flowers in great beautiful masses, making the air redolent with the smell of honey. It only requires a small capital for the cost of bringing the bees here, and in these mountains there is only the bears and the winter to disturb you. The description of the unsettled portion would furnish enough interesting letters to keep you in correspondence the whole season. But if you are not interested, if you will hand this to some one likely to be interested enough to try the experiment I shall be satisfied.

Yours very truly,

JAMES M. HAMILTON, Ass't Engineer.

Boise City, Idaho, Sept. 7th, 1883.

Astronomy for Amateurs.—October.

BY BERLIN H. WRIGHT.

THE PLANETS.—OCTOBER, 1883.

(All Computations are for the Latitude and Meridian of New York City.)

Mercury may be seen in the latter part of October, being a morning star (at greatest western elongation), and brightest Oct. 22d to 25th. He rises as follows:

Oct. 20th—4 47 morn., 1h. 30m. before sunrise.
" 25th—4 55 " 1h. 28m. " "
" 30th—5 17 " 1h. 12m. " "

and about 12° north of the sunrise point, and 2° south of east point.

He will be moving eastward past the stars of the constellation Virgo, being in conjunction with the 3d mag. star *Gamma* Virginis on the 20th, and only about 1° south of that star. On the 27th he will be 5° 20′ north of the bright star *Spica* Virginis, and on the 29th 3° north of the Moon.

Venus, although an evening star, will scarcely become visible this month, setting, as she does, on the 30th at 5.24 eve.

Mars is still a late riser. He is in the cluster of small stars called Præsepe in Cancer on the 24th; in conjunction with Jupiter on the 19th, being only 1° north of the giant planet, and 7° north of the Moon on the 23d. Mars rises as follows:

October 10th—11 25 evening.
" 20th—11 10 "
" 30th—10 54 "

Jupiter is passed by Mars on the 19th, previous to which time he was to the east of Mars. He rises as follows:

October 10th—11 45 evening.
" 20th—11 11 "
" 30th—10 36 "

The Moon passes 5° south of Jupiter on the 23d, and he reaches his western quadrature on the 27th.

Saturn is retrograding or moving westward past the stars near the Hyades, and rising at a very convenient hour, as follows:

October 10th—8 3 evening.
" 20th—7 23 "
" 30th—6 41 "

Neptune is now nearly at apposition to the Sun, at which time he is brightest, but even under these favorable circumstances a good instrument and a precise knowledge of his location is necessary to find him. He passes the Meridian as follows:

Oct. 10th—2 0 morning in R.A. 3h. 14m. + 16° 9′
" 20th—1 20 " " 3h. 13m. + 16° 5′
" 30th—0 40 " " 3h. 12m. + 16° 1′

He may be found 8° a trifle west of south of the Pleiades.

ECLIPSES.

Two of the four eclipses of this year occur in the month of October. The first is a Partial Eclipse of the Moon, October 15-16, visible throughout this country. See the following table, where the evening time occurs on the 15th and the morning on the 16th.

TABLE OF PARTIAL ECLIPSE OF THE MOON, OCTOBER 15-16, 1883.

	Eclipse Begins.		*Middle of Eclipse.*		*Eclipse Ends.*	
	H.	M.	H.	M.	H.	M.
Albany, N. Y.	1	3 m.	1	59 m.	2	55 m.
Austin, Texas	11	27 e.	0	23 m.	1	19 m.
Baltimore, Md	0	52 m.	1	48 m.	2	44 m.
Boston, Mass	1	14 m.	2	10 m.	3	6 m.
Buffalo, N. Y.	0	42 m.	1	38 m.	2	34 m.
Charleston, S. C.	0	38 m.	1	34 m.	2	30 m.
Chicago, Ill	0	7 m.	1	3 m.	1	59 m.
Cincinnati, O	0	20 m.	1	16 m	2	12 m.
Denver, Colorado	10	58 e.	11	54 e.	0	50 m.
Galveston, Texas	11	39 e.	0	35 m.	1	31 m.
Kansas City, Mo.	11	39 e.	0	35 m.	1	31 m.
Nashville, Tenn.	0	11 m.	1	7 m.	2	3 m.
New Haven, Conn.	1	6 m.	2	2 m.	1	58 m.
New Orleans, La.	11	58 e.	0	54 m.	1	50 m.
New York City.	1	2 m.	1	58 m.	2	54 m.
Omaha, Neb.	11	34 e.	0	30 m.	1	26 m.
Philadelphia, Pa.	0	57 m.	1	53 m.	2	49 m.
Providence, R. I.	1	13 m.	2	9 m.	3	5 m.
Richmond, Va.	0	48 m.	1	44 m.	2	40 m.
Rochester, N. Y.	0	47 m.	1	43 m.	2	39 m.
San Francisco, Cal.	9	48 e.	10	44 e.	11	40 e.
St. Louis, Mo.	11	57 e.	0	53 m.	1	49 m.
St. Paul, Minn.	11	46 e.	0	42 m.	1	38 m.
Washington, D. C.	0	50 m.	1	46 m	2	42 m.

Size of Eclipse = 3.36 Digits.

The second is an Annular Eclipse of the Sun, October 30th, visible as a partial eclipse on the southern limb of the Sun in the Pacific States;

the Sun setting with the eclipse of about 8 digits still upon it. At San Francisco the eclipse begins at 3h. 40m. in the afternoon. Visible nearly as far east as the Black Hills in Wyoming Territory, and Denver, Colorado, where the eclipse begins just after sunset. At Santa Fe, N. M., it will be a mere contact of limbs at sunset. At Helena, Mont., the eclipse begins at 4.40 P.M. At Walla Walla the beginning occurs at 3h. 48m., and the middle at sunset. At Portland, Oregon, begins at 3h. 38m., and the middle at sunset.

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS, OCT. 21ST, 1883.

	H.	M.	
Alpha Andromeda (Alpheratz) in meridian	10	2	eve.
Omicron Ceti (Mira) variable, in meridian	0	17	mor.
Beta Persei (Algol) variable, in meridian	1	3	"
Eta Tauri ("Seven Stars" or Pleiades) rises	6	12	eve.
Alpha Tauri (Aldebaran) rises	7	31	"
Alpha Auriga (Capella) in merid.	3	11	mor.
Beta Orionis (Rigel) rises	9	38	eve.
Alpha Orionis (Betelguese) rises	9	23	"
Alpha Canis Majoris (Sirius or Dog Star) rises	11	39	"
Alpha Canis Minoris (Procyon) rises	11	14	"
Alpha Leonis (Regulus) rises	1	21	mor.
Alpha Virginis (Spica) rises	5	58	"
Alpha Bootis (Arcturus) rises	5	1	"
Alpha Scorpionis (Antares) sets	6	43	eve.
Alpha Lyrae (Vega) sets	1	30	mor.
Alpha Aquillae (Altair) sets	0	18	"
Alpha Cygni (Deneb) "	4	36	"
Alpha Pisces Australis (Fomalhaut) sets	0	54	"

De Land, Florida.

Human Hair Under the Microscope.

E. B. Tylor, in *Nature*, says that the microscopic examination of the cross section of a single human hair is sufficient to determine to which one of the race divisions of humanity the wearer belongs. If examined microscopically by Pruner's method, it shows circular, or oval, or reniform. Its follicle curvature may be estimated by the average diameter of the curls as proposed by Moseley. Its coloring matter may be estimated by Sorby's method. There has been even a systematic classification of man published by Dr. W. Muller, of the Novara expedition, which is primarily arranged according to hair, in straight-haired races, curly-haired races, etc., with a secondary division according to language.

Telegraphy in Rhyme.

A - — "A" 's a dot and then a dash;
B — - - - "B," dash, three dots like a flash;
C - -   - "C," two dots, a space, a dot;
D — - - Dash, two dots, and "D" you've got;
E - "E" is but a period—
Readers, are you wear-i-ed?

F - — - "F" is made thus—dot, dash, dot;
G — — - Dash, dash, dot, to "G" allot;
H - - - - Four dots, "H"—how's that for high?
I - - Two dots "I" will satisfy;
J — - — - "J," dash, dot, dash, dot, you sound;
K — - — Dash, dot, dash for "K" you've found.

L —— "L" 's long dash, so rest your hands!
M — — Next two dashes "M" demands;
N — - "N" 's dash, dot, made closely—see?
O -   - "O" 's a dot, space, dot—O, me!
P - - - - - Five dots next for "P" suffice;
Q - - — - "Q," two dots, dash, dot—how nice!

R -   - - Dot, space, two dots for "R" next;
S - - - "S," three dots—now watch my text;
T — "T" 's short dash, half size of "L";
U - - — "U" 's two dots and dash—that's well!
V - - - — "V" is three dots, dash—art tired?
W - — — "W" 's dot, two dashes wired.

X - — - - Dot, dash, two dots, "X" you'll find;
Y - -   - - "Y," two dots, space, two dots, mind!
Z - - -   - Three dots, space and dot are "Z";
& -   - - - "&" is vice versa—see!

The Origin of Lightning.

In explaining satisfactorily the phenomenon of lightning, a difficulty is encountered in accounting for the enormous electric tensions which are necessary to explain the great length of the spark often observed The theory is advanced by A. Fick that the high tensions are produced by the sudden concentration of electricity already existing in a free state. This concentration is caused by the formation of large drops of rain from the small vesicles of moisture existing in the clouds, by which the surface upon which the electricity exists is greatly diminished. The sudden formation of drops of water from the mass of aqueous vapor may be due to the advance of cold-air currents. Mr. Fick endeavors to answer two objections which may be urged against this theory: 1. That in every rain storm lightning ought to be seen. 2. That it ought to rain whenever it lightnings. To the first objection he replies that the drops may be formed gradually, and not suddenly, in which case the tensions would be dissipated gradually; and to the second, that drops are always formed in connection with lightning, but that in falling to the earth they sometimes encounter a layer of dry air, and are absorbed in their passage.

Ye Ancient Dude.—The Æsthetic Wonder of the Eighteenth Century.

A new kind of dandy appeared in 1770. It was customary in the last century for young men of rank to finish their education by making the grand tour of the Continent, and a number of them at the close of their travels formed a club in St. James Street, which they called the Savoir Vivre Club. They had periodical dinners, at which they introduced the now familiar, but then unusual dish, macaroni, and, first applied to members only, this strange name was afterwards used to describe all such exquisites as they were.

They were the objects of as much ridicule as the modern "dude." Wearing their hair drawn high above the scalp in the shape of a bee hive, with long curls at the side and an enormous chignon, they crowned this superstructure with an exceedingly small cocked hat. Their coats, waistcoats, and breeches were scant, the latter being of striped silk, with bunches of ribbon at the knee. They carried long canes, decorated with silk tassels, and wore two watches, with large bunches of seals hanging from them. Around their necks they had white ties, fastened under their chins with an immense bow. Their calves were displayed in white stockings, and their feet encased in small shoes with diamond buckles. The ladies vied with the men in the extravagance of their costume, and likewise wore their hair in great puffs, which seemed to overbalance their bodies.—*Boston Herald.*

Scientific News.

—The whistle of a locomotive is heard 3,300 yards, the noise of a train 2,800 yards, the report of a musket and the bark of a dog 1,800 yards, the roll of a drum 1,600 yards, the croak of a frog 900 yards, and a cricket's chirp 800 yards.

—It has been observed that "right-handedness" extends far down in the scale of creation. Parrots take hold of their food in their right foot by preference, and insects, like wasps, beetles and spiders, use the right anterior foot most frequently.

—Deaf mutes are taught to speak and comprehend by watching the movements of the lips. According to the *Photographic News*, M. Wanerke has photographed the face of a man in which these movements were perfectly defined, so as to have the exact form corresponding to each sound. By means of these photographs inexperienced persons have been enabled to recognize the different articulations.

—The following is the estimated railway mileage of the world, January 1st, 1883; United States, 113,000 miles; Europe, 109,000; Asia, 8,000; South America, 7,000; Canada, 8,500; Australia, 3,200; Africa, 2,200; Mexico, 2,100. Grand total, 253,000 miles. These figures, however, are not claimed to be exact, being based upon the latest available returns, to which the probable increase since such period has been added.

—Professor H. G. Williams has been engaged in the study of the Devonian section of Western New York, under the direction of the Paleontologic Branch of the United States Geographical Survey. He reports good progress. Mr. L. C. Wooster was engaged during July in the collection and study of Potsdam fossils. He has been quite successful in these collections, and has already forwarded eight boxes to the National Museum here.

—The name of Roebling, the man who built the Brooklyn bridge, which has just been completed at a cost of more than $20,000,000, is put as architect on a wooden bridge across Little Hickman creek, in Jessamine county, Ky., dated 1855. The father was killed in the construction of the Brooklyn bridge and the son so wounded that he was confined to a room from which he watched the construction with a telescope, while his wife was the bearer of his orders.

—An interesting experiment in heliography, or signalling by sunshine, was successfully made in Egypt during the recent campaign. Colonel Keyser ascended one of the pyramids near Cairo, and by means of a heliographic mirror reflected a ray of sunlight to Alexandria, 120 miles away. At that great distance the signals, appearing like pin points of brightness, were easily ascertained to be a message from Sir Garnet Wolseley to the Khedive.

—The utilization of slag waste is fast assuming considerable economical importance. The manufacture of bricks from granulated blast-furnace slags will soon be begun in Germany. The slags are run into water, and the grit thus obtained is mixed up with lime, concrete, or plaster-of-Paris, and formed into bricks, which are dried for a month. They possess greater solidity than common brick, and seem to resist a much greater pressure.

—Prof. Sir W. Thomson, in his new treatise on natural philosophy, is led by a consideration of the necessary order of the cooling and consolidation of the earth to infer that the interior of our globe is not, as commonly supposed, all liquid, with a thin solid crust of from 30 to 100 miles thick, but that it is on the whole more rigid than a continuous solid globe of glass of the same diameter, and probably more rigid than such a globe of steel.

—It seems to me I can best lay this ghost of our animal origin by drawing attention to the fact that the swinging of any part that is sufficiently free may be used for steadying the body in walking. In man the arms are used, because most movable; but in lower animals the head is most often used. The domestic fowl moves the head back and forth alternately with the move-

ment of the legs; the horse moves the head up and down; the cow moves the nose back and forth. Are these movements ghosts of a former real walking with the head?—*Joseph Le Conte, in Science.*

—A correspondent in writing from New York says, judging from present indications, gilding on plaster for ornamenting mirror frames will soon be a fashion of the past. The utmost ingenuity is exercised in framing, and sometimes with charming effect. A mirror lately seen was framed in old tapestry of a dull gold ground, on which, on either side, are pictured mediæval saints with golden nimbus and robes of dull red and blue. Across the upper and lower parts of the frame are wrought festoons of flowers. A second mirror shows an oaken frame with a band of dull gold, on which are applied garlands of carved flowers.

Practical Hints.

—Wire rope must not be coiled or uncoiled like hemp rope. When mounted on a reel the latter should be turned on a spindle to pay off the rope. When forwarded in a coil without reel, roll it over the ground like a wheel and run off the rope in that way. All untwisting must be avoided.

—For poison ivy, bathe the parts in a decoction of hemlock boughs or of oak leaves, or with a teaspoonful of copperas (sulphate of iron) in a small teacupful of boiling water; or rub wet salt on the affected parts. If the blisters are broken, one application of nitre will be sufficient.

—Fat is said by Dr. F. L. Oswald to be the best lung food, and among all fat-containing substances sweet cream is the best, salt pork the least nutritious. Consumptives should avoid all scorbutific articles of diet; salt meat, pickles, cheese, pungent spices, made dishes, and all intoxicating drinks.

—A new invisible ink has been introduced by Dr. Widemann. It is made by intimately mixing linseed oil 1 part, water of ammonia 20 parts, and water 100 parts. The mixture must be agitated each time the pen is dipped into it, as a little of the oil may separate and float on the surface, from which, if taken up by the pen, a stain would be left upon the paper. To make the writing appear all that is needed is to dip the manuscript in water; when the paper dries the writing will vanish.

—A German journal gives the following leather polish:—Mix 200 parts of shellac with 1 000 of spirits—95 per cent.—in a well-stoppered bottle. Keep in a warm place for two or three days, shaking frequently. Separately dissolve twenty-five parts of Marseilles soap in 375 of warmed spirits—25 per cent.—and to the solution add forty of glycerine. Shake well and mix with the shellac solution. To the mixture add five parts of nigrossin dissolved in 125 of spirits. Well close the vessel and shake energetically, and then leave the mixture in a warm place for a fortnight.

—A very good fly-paper may be made after the following receipt: Gum turpentine, 10 parts; yellow wax, 4 parts; lard, 14 parts. Melt, strain through a muslin cloth, and after solidification add as much oil (say linseed) as may be necessary to give the proper consistency on the paper. When prepared lay two papers together, face to face. If the above proportions do not give just the results desired, they should be varied by taking different quantities of the ingredients until a satisfactory material is made.

—Soapsuds will not chap or injure the hands even if kept a long time in it, if on taking them from the suds they are thoroughly sponged, or dipped in lemon juice or vinegar. The acid destroys the corrosive effects of the alkali and makes the hands soft and white. Indian meal and lemon juice, used when washing the hands when roughed by cold or hard work, will heal and soften them. Vinegar will answer if lemons are not easily obtained. Rub the hands in this, then wash thoroughly, and if you have it, after drying put on a few drops of glycerine. Those who suffer from chapped hands in the winter will find this comforting, and will make sewing much easier.

Notes and Queries.

In continuing this department, which has been found of so much value, we would remind our readers who wish for information on any of the arts and sciences, that they are cordially invited to make their wants known through this column, and those of them who can furnish accurate answers to questions asked are requested to send in replies. Doubtless many of our subscribers may know of methods, processes, or devices that may be better or more suitable for the particular case in question than anything generally known, and it is this reason that induces us to keep this department open for a medium, where an interchange of ideas and practices may be made to the advantage of all our readers. Correspondents will please send their full address when forwarding their communications—either questions or answers—not for publication, unless expressly so stated, but so that we may know where to find the writer if desirable. Communications should be sent in on or before the first of each month previous to publication, to insure insertion in next issue.

Answers.

115. In answer to Katie B. (August YOUNG SCIENTIST) as to impression of leaves, I would recommend the following: Bichromate of potash, 10 grs.; sulphate of copper, 20 grs.; distilled water, 1 oz. Wash a piece of letter paper on one side with this solution, and let it dry in the dark. Procure a pane of window glass free from specks, a piece of thin board the size of the glass; lay several pieces of paper and a piece of black cloth the size of the glass and board, placing the paper next to the board, the cloth on the paper, and on the cloth the sensitive paper (this should always be kept in the dark until you are ready to use it), and on this place the leaf; over the whole place the glass; fasten with spring clothes pins, and expose to clear sunshine a few minutes; remove, and wash the picture in the dark with a solution of nitrate of silver of moderate strength. Engravings may also be copied by this method.—CAMERA, JR.

116. To gild on glass, first clean and dry the glass thoroughly, then lay out the lines for letters with a piece of hard scented soap, then paint the letters on the *right* side of the glass with lampblack mixed with oil, in order to *form a guide for the work,* then on the inside lay on a coat of size, using a camel's-hair brush, covering the whole of the letters; next lay on the gold leaf with a tip, until every part of the letters is covered well. Let the leaf remain until the size is dry, when you will find that the letters on the front side can be easily seen and traced. This is done with quick drying black, mixed with a little varnish. Paint over the whole directly over the gold; allow it to dry; then wipe off with soap and water the lampblack letters from the front side; with pure cold water and a clean sponge, wash the superfluous gold leaf and size from the back, and you will have a splendid gold letter on the glass; next, shade your letter to suit the taste, always remembering to shade to the edge of the gold, for then you have only *one* edge to make straight. The other edge may be left rough, and when dry may be straightened by scraping with a knife.

In making scrolls, eagles, etc., on glass, some painters put on the outlines and shades first, and then lay the gold leaf over all; another good way is to scratch the shades on to the gold leaf after it is dry, and put the colors on the back of the gold. Silver leaf may be used in the same manner as gold, but it will not wear as well. A very pretty letter may be made by incorporating silver with gold: take paper and cut any fancy design to fit the parts of the letter; stick it on the size before laying the leaf, allowing it to dry, and wash off as before; then with a penknife raise the paper figure, and the exact shape or form of the figure will be found cut out of the the gold letter; clean off nicely, apply more size, and lay *silver* leaf to cover the vacant spots; wash off when dry, and a very handsome letter will be the result. Colors may be used instead of silver, if desired, or a silver letter edged or "cut up" with gold, will look well.—SNOB.

117. SADIE.—Drop your shells into hot water, and gradually increase its temperature to boiling point. When they are quite dry rub them over with a little olive oil. Sea-shells should be steeped in water till the salt is extracted. Coral is bleached by being boiled in water to which oxalic acid has been added.

118. In strict architectural parlance—yes; in ordinary language—no. The house should be larger than the villa, and the villa than the cottage; but in almost every suburban street where the houses are identical in size, plan, and construction, you will find one man calling his dwelling a "house," his next door neighbor rejoicing in a "villa," while his friend to the left is satisfied with a "cottage," and his next-door-but-one proclaims itself to be a "residence."

119. Make a box with the top, bottom and sides of thin wood, and the ends 1½ inch beech, form it the same length as the width of the window in which it is to be placed. The box should be three or 4 inches deep, and 6 or 7 inches wide. In the top of the box, which acts as a sounding board, make three circular holes about 2 inches in diameter, and an equal distance apart. Glue across the sounding board, about 2½ inches from each end, two pieces of hard wood ¼ inch thick, and ½ inch high, to serve as bridges. You must now procure from any musical instrument maker twelve steel pegs similar to those of a pianoforte, and twelve small brass pins. Insert them in the following manner into the beech: first commence with a brass pin, then insert a steel peg, and so on, placing them alternately ½ inch apart to the number of twelve. Now for the other end, which you must commence with a steel peg, exactly opposite the brass pin at the other end, then a brass pin, and so on, alternately to the number of twelve; by this arrangement you have a steel peg and a brass pin always opposite each other, which is done so that the pressure of the strings on the instrument shall be uniform. Now string the instrument with twelve first violin strings, making a loop at one end of each string, which put over the brass pins, and wind the other ends round the opposite steel pegs. Tune them in unison, but do not draw them tight To increase the current of air, a thin board may be placed about 2 inches above the strings, supported at each end by two pieces of wood. Place the instrument in a partly opened window, and to increase the draft open the opposite door. See back numbers of the YOUNG SCIENTIST for further information.—MUSIC.

120. JUMBO.—Is the density of the matter of which any body is composed, compared with the density of another body assumed as the standard, or 1,000. This standard is pure distilled water for liquids and solids, and atmospheric air for gaseous bodies and vapors. Thus as gold is 19 and silver ten times heavier than water, those numbers, 19 and 10, are said to represent the specific gravity of gold and silver. The heaviest known substance is iridium, used for pointing gold pens; its specific gravity is 23. The lightest of all liquids has a specific gravity of 0.6, it is called chimogene, and is made from petroleum; it is exceedingly volatile and combustible, being, in fact, a liquefied gas. Carbonic acid gas or choke damp is 500 times lighter than water, common air 800, street gas about 2,000, and pure hydrogen, the lightest of all substances, 12.000 times. The heaviest substance has thus 23 + 12,000, or more than a quarter of a million times more weight than an equal bulk of the lightest; and the substance of which comets consists is supposed by astronomers to be even several thousand times lighter than hydrogen gas.—KINO.

121. ANTIQUARIAN.—The oldest specimen of pure glass bearing anything like a date is a little moulded lion's head, bearing the name of an Egyptian king of the eleventh dynasty, in the Slade collection at the British Museum. That is to say, at the period which may be moderately placed at more than 2,000 years B. C., glass was not only made, but made with a skill which shows that the art was nothing new. The invention of glazing pottery with a film or varnish of glass is so old that among the fragments which bear inscriptions of the early Egyptian monarchy are heads possibly of the first dynasty. Of later glass there are numerous examples, such as a bead found at Thebes, which has the name of Queen Hatasoo, or Hashep, of the eighteenth dynasty. Of the same period are vases and goblets and many fragments. It cannot be doubted that the story prepared by Pliny, which assigns the credit of the invention to the Phœnicians, is so far true that these adventurous merchants brought specimens to other countries from Egypt. Dr. Schliemann found disks of glass in the excavations at Mycenæ, though Homer does not mention it as a substance known to him. That the modern art of the glass-blower was known long before is certain from representations among the pictures on the walls of a tomb at Beni Hassan, of the the twelfth Egyptian dynasty; but a much older picture, which probably represented the same manufacture, is among the half-obliterated scenes in a chamber of the tomb of Thy at Sakkara, and dates from the time of the fifth dynasty, a time so remote that it is not possible, in spite of the assiduous researches of many Egyptologers, to give it a date in years.—KERAMIC.

122.—To KATIE B.—The writer of the lines you quote was Charles Swain.—PHILIP.

Queries.

123. Having a lot of fancy chickens, and wishing to keep them all winter, I am desirous of having a warm house built for the purpose. Do you think a house built of gravel or concrete would be warm enough? and if so, could you give me a few hints regarding the materials to be

employed, and the manner of putting the house up, as I wish to do all the work on it myself, not being rich enough to employ a regular mechanic?—NEW HAMPSHIRE BOY.

124. Ought a clever boy, 16 years of age, be able to construct a cheap and comparatively correct barometer? If so, how ought he to go about the work.—WEATHERWISE.

125. I am taking lessons on the violin, and would like to know something about the instrument I am learning to play on, and also what are the peculiarities that make what are called the "good points" of a violin?—F. K. DANBURY.

126. How can I bore or drill a hole through a glass plate?—PUZZLED.

127. I have a pet dog—a little English terrier—also a canary; both are ill, and seem pining away. I don't know what is the matter with them; can any reader suggest anything that I can do for them?—DAISY, N. J.

128. If some one will answer the following questions I will feel obliged: (1) What is good for removing dandruff from the scalp? (2) How may I remove grease spots from a Cashmere garment? (3) What will remove ink stains from cloth?—DAISY, N. J.

129. (1) When and where were the first bicycles and velocipedes made? (2) Who first adopted the india-rubber tires? (3) Does a plated machine keep clean easier than a polished one? (4) How can I keep the spout of my oil can from getting choked up?—CYCLIST, Orange, N. J.

130. I have seen somewhere an account of what a horse can do in a given time. I would like to see the item referred to in print in the YOUNG SCIENTIST; if any fellow reader who may have the item in his possession, will forward it to you for publication, and if you will be kind enough to publish it. I am sure it will be interesting to many of your readers, besides a—FARMER BOY N. Y.

131. How are cameos made, and what do portraits in cameo cost.—LITTLE MAIDEN, Mich.

132. C. H. P., R. S., L. V. M., and several others would like to have designs of monograms in rustic style of the above letters. We have also a number of other requests for monograms in various styles and combination. We will publish a whole page of monograms in our January issue, in which we will try and illustrate most of those asked for. In the mean time, we hope those of our friends who are able to design will send in such combinations as they may see fit.—[ED.]

Market Report.

Retail Prices.

IMPORTED CAGE BIRDS.

Canaries, *Belgian*, per pair	$6.00 to 15.00
" *French*, per pair	6.00 to 15.00
" *German, Hartz Mts.*, each	2.50 to 10.00
Gold Finches, each	1.50
Gold Finch (mules), each	2.50 to 5.00
Bull Finches, not trained, each	2.50
Bull Finches, trained to sing two tunes, each	10.00 to 40.00
African Finches, per pair	2.50 to 5.00
Chaffinches each	1.50
Talking Mino or Mina	10 00 to 25.00
Linnets, each	1.50 to 2.00
Linnets (mules), each	2.50 to 5.00
Green Linnets, each	1.50
Java Sparrows (blue), each	1.50
Java Sparrows (white), per pair	6.00 to 8.00
English Sparrows, per pair	1.00
Siskins, each	1.00
Gray Cardinal, each	4.00 to 5.00
Nightingales, each	8.00 to 25.00
Japanese Nightingales, each	5.00 to 10.00
Thrushes, each	5.00 to 7.00
Skylarks, each	5.00
Troopials, each	7.00 to 12.00
European blackbirds, each	5.00 to 7.00
Black-caps, each	4.00
Starlings, each	4.00 to 6.00

PARROTS.

Gray Parrot	10.00 to 15.00
Single Yellow-Head Parrot	8.00 to 12.00
Double Yellow-Head Parrot	10.00 to 15 00
West Indian "	4.00 to 5.00
Cockatoo (white)	18.00
Australian Shell Paraquets, per pair	6.00
"Love Birds," African Paraquets, per pair	6.00
West Indian Paraquets, per pair	3.00 to 5.00

All birds that are accomplished singers or talkers bring high and "fancy" prices. Parrots are rated by the number of words, sentences, and tunes they have learned.

AMERICAN CAGE BIRDS.

Canaries, each	2.50
Mocking Birds, females, each	1.00
" " singers	12.00 to 25.00
Robins	2.50 to 5.00
Blue Birds ("Blue Robins") each	1.50
Indigo Birds, each	1.00
Nonpariel, each	1.50 to 2.00
Virginia Cardinal, each	2.50 to 3.00
Bobolinks, each	1.50 to 2.00
Yellow Birds, each	1.50 to 2.00

Prices Paid by Dealers.

Robins, per hundred	12.00
Blue Robins (Blue-Birds), per pair	0.35
Indigo Birds, each	0.50
Bobolinks, per dozen	3.00
Yellow-Birds, per hundred	12.00
Orioles, per hundred	25.00 to 35.00
Virginia Cardinals (Red-Birds), each	0.75 to 1.00
Nonpareils, each	0.75
Blue-Jays, each	0.35
Scarlet Tanagers, each	1.00
Red-Winged Starlings, or Black-Birds, each	0.25
Woodpeckers ("High-Holers"), each	1.00
Partridges, each	1.50
Cranes, each (according to variety)	10.00 to 20.00
Wood-Ducks, per pair	2.50
Wild Bronze Turkeys (one cock, two hens)	10.00 to 15.00

FANCY POULTRY.

Guinea or Pea-Hens	12.00
Pheasants, *English*, per pair	20.00
" *Golden*, "	35.00
" *Silver*, "	30.00
Pea-Cocks, per pair	20.00 to 75.00
Bronze Wild Turkeys	15.00 to 20.00
White Turkeys	10.00 to 15 00
Bantams, trio	3.00 to 10.00
Ring-Doves, per pair	1.50
Pigeons, *common*, per pair	0.75
" *all white, common*, per pair	1.00

BIRD FANCIERS' MATERIALS.

Breeding Cages (double)	1.50 to 4.00
Trap Cages	0.75
Wire " painted	0.50 to 4.00
Wood and Wire Cages	1.50 to 4.00
Prepared Bird Food, per quart	0.30
Bird Gravel, per quart	0.05
German Rape Seed, per quart	0.20
Canary Seed, per quart	0.20
McAllister's Mocking-Bird Food, 1lb. jar	0.35
" Canary-Bird Food, 1lb. box	0.20
" Mixed Bird Seed, 1lb. box	0.10
" Extra Silver Bird Gravel, qt. box	0.10
McAllister's Prepared Fish Food, per box	0.10
" Song Restorer, for birds, per bot.	0.25
McAllister's Bird-Lice Destroyer, in patent bellows box	0.25
McAllister's Bird Lime, per box	0.25
Cuttle-Fish Bone, each	0.05
Meal-Worms, per hundred	0.40
Nest Boxes, wire and tin	0.10 to 0.15
Nest Material, per bunch	0.10

QUADRUPEDS.

Terriers, *black and tan*, each	5.00 to 30 00
Terriers, *Scotch and Skye*, each	5.00 to 30.00
Newfoundland Pups, each	10.00 to 15.00
Pomeranian or Spitz "	5.00 to 15.00
Greyhounds, *English*, "	10.00 to 25.00
Greyounds, *Italian*, "	10.00 to 30.00
Guinea-Pigs, *common*, per pair	1.50
" " " " large	1.50 to 3.00
Guinea-Pigs, *all white*, "	2.00
Squirrels, *gray*, "	5.00
Squirrels, *all white* "	15.00 to 25.00
Squirrels, *flying* "	3 00 to 4.00
Squirrels, *small red* "	2.00
Rabbits, *common*, per pair	1.00 to 2.50
Rabbits, *fancy breed*, according to age and purity of breed, per pair	3 00 to 15.00
Ferrets, *English*, "	15.00
Raccoons, each	4.00 to 5.00
Cats, *Maltese* (males), each	5.00
" " (females), each	3.00
Cats, *Albinos, pink or blue eyes*, each	3.00 to 5.00
Rats, *white China, pink eyes*, per pair	1.50
Rats, *piebald*, per pair	1.50
Mice, *white, pink eyes*, per pair	0.50
Mice, *piebald*, per pair	0.50

Prices Paid for Pet Stock by Dealers.

Guinea-Pigs, per pair	$0.40
Squirrels, *gray*, each	0.50
Squirrels, *flying*, per pair	0.75
White mice, per pair	0.15
Monkeys, according to variety	15.00 up.

MARINE AQUARIA STOCK.

Purple Bermuda Anemone	2.00
Fringed Sea Anemone, Medium-sized specimens	1.50
White-Armed Anemone	0.50
Small Orange "	0.10
Buccinum Snails, per dozen	0.25
Silver Shrimp, each	0.10
Small Hermit Crabs, each	0.15
Small Spider Crabs (decorating)	0.15
Very Small Edible or Blue Crabs	0.20
Barnacles, each	0.15
Nest-Building Stickle-Backs, three and nine-spined, per pair	0.30
Sheepshead Lebia fish	0.25
Killie-Fish	0 10
Eels	0.10
Sea-Horses, each	3.00
Pipe-Fish, "	0.25
Serpulæ, per mass	0.75
Small Edible Mussels, per mass	0.25
Sea Cucumbers	1.00
Sertularia, per mass	0.25
Tubularia, per mass	0.25

ALGÆ (SEA-WEEDS), FOR THE MARINE AQUARIA.

Ulva, per mass	0.25
Solaria, "	0.25

FRESH WATER AQUARIA STOCK.

Stickle Backs, Nest-building, per pair	0.30
Plants, per bunch	0.15
Shells, per quart	0.50
Small Dip-Nets	0.50
Aquaria Cement 1lb. box	0.30
Small Turtles, each	0.25
Snails, per dozen	0.10
Frogs, each	0.15
Fresh-Water Mussels	0 05

For the Microscope and Fresh Water Aquarium.

Valisneria Spiralis, per bunch	0.25
Nitella-Flexilis, "	0.25
Anacharis, "	0.15
Ball Plant (Utricularia)	0 15
Small Rock Sun-Fish, Rock-Fish, Sun-Fish, Dace, Cat-Fish, Tadpoles, Eels, Lizards, each	0.05

These are all varieties of the golden carp or gold-fish.

Gold-Fish, medium size.	0.15
" fountain size	0.25
" very small	0.15
" three-tailed	0.50
Pearl-Fish	0.25
Silver-Fish	0 05
Japanese King-gio	2.00

Prices Paid by Dealers.

Aquarium fish, per hundred	1.50
Gold Fish, per hundred	5.00 to 6.00
Aquarium Plants, per hundred bunches	2.00

BEAUTIFUL AND INTERESTING AQUATIC AND SEMI-AQUATIC PLANTS FOR ORNAMENTATION OF PONDS, LAKES, AQUARIA AND FOUNTAINS.

White Water-Lily, per root	0.25
Yellow " "	0.25
Arrowhead Lily, 6 plants	0.25
Calla-Lilles	0.25
Pitcher-Plants, per root	0.25
Fresh-Water Cattails, per root	0.25
Giant Rush " "	0.25
Floating Heart (Limnantheum), per root	0.25
Calamus (sweet-flag), per root	0.25
Water-Cress, cuttings	0.25
Jack-in-the-Pulpit, 6 bulbs	0.25
Lobelia Cardinalis	0.25
Large, Showy Blue Lobelia	0.25
Water Violet (very curious)	0.25
Antipyretica Gigantia, interesting	0.25
" Fontinallis, interesting	0.25
The Water Net	0.25
Large Living Frogs	0.10

SHELLS.

Collections of small "cabinet" shells for schools, private cabinets, range from $5.00 to $50.00.

Mother-of-pearl shells, for painting, 75 cts. to $1.50.

Single specimens of cabinet shells range from 15 cts. each to $3.00.

Masses of corals, 25 cts. to $3.00.

Green snail and cowry, with the Lord's Prayer engraved on them, 50 cts. to $2.50 each.

Conch shells, for mantels or hearthstone ornaments: West India Conch, 25 cts.; East India Yellow Helmet, $1.00 to $2.50; Bahama Black Helmet, 50 cts. to $1.50; Bahama Hatchet Helmet, 50 cts. to $1.25. These shells are also for cameo engraving. Zanzibar Cameo, 25 cts. to $1.00.

Ground and polished shells: New Zealand Green Ear, 50 to 75 cts.; New Zealand White Ear, 50 to 75 cts.; Japan Black Ear, 50 cts. to $1.00; California Red Ear, 75 cts. to $1.25.

Fine shells for fancy work, according to colors and variety, per quart, $1.00 and up.

Fancy Wood for Scroll Sawing.

The prices given for the various woods used in this work are for the best of qualities of seasoned material, planed on both sides, ready for immediate use. They can be furnished in quantities to suit purchasers. Prices are by the square foot, and vary according to thickness of material.

DESCRIPTION.		THICKNESS. 1-8	3-16	1-4
Black Walnut	Per Ft.	7	8	10
White Holly	"	10	12	14
Oak or Ash	"	8	10	12
Mahogany	"	10	12	14
Red Cedar	"	10	12	14
Rosewood	"	18	20	25
Satinwood	"	25	30	35
Birds'-Eye Maple	"	15	18	20
Tulip	"	30	40	50
Ebony	"	50	60	70
Cocobola	"	20	25	30
Amaranth	"	20	22	25

BEST IMPORTED SAW BLADES. 5 INCHES LONG.

Sizes to No. 6, per dozen	10c
" " " gross	$1.00
" No. 7 and 8, per dozen	15c
" " " " gross	1.25
" No. 8 and 10, " dozen	oc
" " " " gross	1.50

For all information on this subject, as to reliable dealers, etc., etc., send postal card to YOUNG SCIENTIST. When desired, the goods can be sent through this office, but in all cases remittances must accompany the order.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business matter in letters or cards they are filed away and never reach the printer.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

A number of first-class tricks, trick books, stamps, coins, Confederate money, curiosities, etc., to exchange for stamps or pet stock, such as rabbits, Guinea pigs, or squirrels. J. S. Reese, 52 Cedar St., Canton, Ohio.

Shell boat, Spanish cedar, 28 feet long, spoon oars; good order; been used but little; for offers. J. W. B., Carmel, N. Y.

Rowing machine, cost $10; photographic outfit, $16; Flobert rifle, $15; medical battery, $10; "Wood's Botany," etc.; for elk horns, deer horns, minerals, Indian relics, and all kinds of curiosities. would like list of curiosities from dealers. Chas. C. Collier, 3617 Locust St., Philadelphia, Pa.

Vol. III. of the *American Machinist* for the best offer of minerals. J. A. S., P. O. Box 83, East New York.

I have five or six complete years of the *Galaxy* (magazine) also a number of odd copies; I will exchange the lot for an induction coil in good condition, and giving at least a ¼ in. spark. W. B. Greenleaf, 480 La Salle Ave., Chicago, Ill.

I have eighteen numbers of the *Harper's Young People* (79 to 96 inclusive), containing part of the story "Tim and Tip," by James Otis, and all of the story "The Cruise of the Ghost," to exchange for a good spyglass, a good bull's-eye lantern, or a small telephone. J. H. Gamsey, Box 25, Wilmington, Will. Co., Ill.

A good violin, bow, box, books, all complete, worth $12.00, to exchange for Wood's Botany, Young Mechanic, or scientific books and papers; send list. A. D. Chamberlain, Trout Creek, Del. Co., N. Y.

A model self-inking printing press, chase 2½ x 3¼, 4 fonts card type, 3 type cases, ink, roller and furniture all in good order, to exchange for a good silver watch and nice chain. G. E. Wilmot, Box 88, Lebanon, N. H.

Any person wishing to exchange foreign stamps please send sheet and I will return it with mine. Box 90, Melrose, Mass.

New Nickels (without "cents") for offers; I also wish to exchange with curiosity, coin and stamp collectors residing in foreign countries. G. S. Griffin, Moline, R. I. Co., Ills.

1 Sea bean, 1 alligator's tooth, 1 small cocoanut, 1 liver bean, lot of other beans and shells and 50 foreign stamps for a printing press and outfit, size of chase about 6¼ x 4 inches; send postal. Geo. O. Riphard, Westminister, Md.

W. C. Roseboom, Cherry Valley, N. Y., wishes to exchange with amateur photographers, or others; photographs and pictures taken by themselves, mounted or unmounted; give name of picture and camera.

I would like to exchange minerals, stamps and curiosities for the same. O. J. Lache, 1313 Poplar St., Philadelphia, Pa.

6 fonts type, 4 cases, 2 composing sticks, leads, rule, etc., outfit except press, to exchange for good tent, not less than 6x6, or offers; send card before exchanging. Wm. O. Brown, Middlebury, Vt.

I have double barrel muzzle-loading shot gun, watch, orguinette, harmonica, stuffed birds for Household microscope, photo. outfit, books on natural history; specimens or offers. E. O. Tuttle, Bristol, Vt.

A printing-press, chase 5½ by 7 inches, in good order; will exchange for a large self-inking press or type. A. W. Barrett, Canajoharie, N. Y.

A one-keyed flute and pair of No. 10 club skates for rifle; E-flat cornet, cost $25, for an eight or six-keyed flute of equal value; all good; or offers. J. L. Pilkington, Pearsalls, L. I.

For fossils or minerals; fine specimens of Pentremites—two varieties—from sub. carb. rocks; also Flobert rifle, in good condition, and McKinnon pen. M. H. Crump, Bowling Green, Ky.

I have for exchange a collection of about 80 species of fine fossils, all named and making a fine collection, which I wish to exchange for opera glass, microscope, telescope, or offers; correspondence solicited. A. Stapleton, Box 756, Seneca Falls, N. Y.

Wanted, amethyst, moss agates, trilobites, geodes, coral, and coal ferns in exchange for fifty Indian arrowheads, coquina rock and Florida moss. E. V. Sheerar, Wellsville, N. Y.

"Crystallography" (40c.); "Electricity" (40c.); "Selection and Use of Microscope," abridged, (30c.) Either in exchange for "Workshop Companion," or two for "The Microscope," by Ross, or offers. C. H. Denniston, Pulteney, N. Y.

Home Medical Battery, cost $7; Lemair's Field-Glass, No. 2202 of Queen's Catalogue, cost $15.50; Achromatic Spy-Glass, power 25 times. To exchange for books or offers. Emerson Heilman, Heilmandale, Pa.

A small collection of coleoptera, comprising 100 species and 300 specimens, all correctly named, in exchange for bird-skins, insects, books, or eggs. Emil Laurent, 621 Marshall St., Phila., Pa.

A small magic lantern, Ruby pattern, with twelve slides, for a good book on Entomology, with illustrations. Willie R. Hotchkiss, Morrisdale Mines, Clearfield Co., Pa.

Wanted, Thompson's "Witchery of Archery." Must be in good condition. Write before you send. J. Anthony, Jr., Coleta, Whiteside Co., Illinois.

A telescope worth $3.50, for a self-inking printing-press and outfit; chase not less than 2½ by 3½ in. Eddie Judd, 260 Connecticut St., Buffalo, N.Y.

To exchange for offers: $20 scroll-saw, Seneca Falls make, $4 Bailey circular plane, set of Auburn metallic planes, brass-bound four-foot rule, fourfold, Traut's patent combined plow, dado, etc., cost $7. F. A. Rappleye, P.O. Box 12, Farmer Village, Seneca Co., N.Y.

Bee Hive wanted; one of the old-fashioned straw "skeps"; say what you would like in exchange. Apis, care of Young Scientist, 294 Broadway, N. Y.

A first-class type writer, in excellent condition, cost $125.00, to exchange for good microscope, telescope, or valuable scientific books; send full particulars. A. B., Box 114, Lewiston, Maine.

A $30 stencil outfit (Spencer's) for a self-inking printing press in good condition, chase about 6x9; rich ores and minerals of Idaho for scientific and instructive books, printing press, type, etc. J. P. Clough, Junction, Lemhi Co., Idaho.

Wanted pyrites of iron from Colorado gold mines in exchange for sea shells and other gems; send list of what you have to exchange. S. Ferguson, Eureka Springs, Arkansas.

A banjo in good condition, two pairs of rosewood bones, three splendid games, and a fine set of drawing instruments, for a good cornet, viola, violincello or double bass. L. B. Hill, Kalamazoo, Mich.

Scientific specimens of various kinds for same. Geo. E. Frazier, Caldwell, Ohio.

Lester W. Mann, Randolph, Mass., Box 162, has Demas scroll saw, lathe and tools, emery wheel; $20 worth patterns; Smithograph; large harmonica, cost $1.75; novelties in seeds; for large self-inking press or offers.

10 volumes Chambers' Encyclopædia, American Book Exchange edition (cloth); Bonanza printing press, chase 3x5, card type, ink roller; spyglass, power 10 times; for French triplet, 1-5 in., or offers. H. P. Nichols, P. O. Address, Bridgeport, Conn.

A good telescope, also foot-lathe and saw combined, each worth $10.00, for shells, fossils or relics. Independent, Conncautville, Crawford Co., Pa.

Birds' eggs to exchange for others; send list of what you have to exchange. Emil Laurent, 621 Marshall St., Philadelphia, Pa.

Twelve or fifteen volumes of the American Agriculturist to exchange for scientific books or offers. W. H. Osborne, Chardon, Ohio.

The Young Scientist

SCIENCE IS KNOWLEDGE. — KNOWLEDGE IS POWER.

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Canaries: How to Keep and Breed Them.—IV.

BY GORDON STABLES.

THE weaning season lasts from the day they begin to crack seeds until they are at least six weeks old, by which time the egg-food, the supply of which has been given in daily diminishing doses, may be left off altogether.

If you intend to go in for what is called aviary breeding, you will have a deal more trouble, but also a deal more pleasure. In this case it is usual to turn in three males with twelve hens. My own advice is to turn in three males with only nine hens; that makes up the dozen, and there is more chance of strong healthy birds. The breeding season, begun in the middle of March, should end early in August, or last week in July. Sell your young birds if possible to private purchasers; if you cannot, then advertise them in papers devoted to live stock, etc. It is in selling especially that you find the advantage of possessing a good prize strain. There is nothing like pedigree animals for breeding purposes, no matter what they are.

I now come to say a few words about moulting. This is a most critical season with all birds, and the first moult of the young canary is eminently so. The moulting season for old birds generally begins some time in July, and extends over three or even four months, as a great deal depends upon the constitution of the bird, and how it is treated. Young birds show evidence of moulting sometimes as early as the seventh week, but any time between that and the tenth week is the usual time. When moulting begins among hen canaries, breeding should be brought to a close; if the male loses feathers first, it is the sign he is weak and the season is over; at any rate you must make it so. Put your hens by

themselves then in roomy cages, and the males either in separate cages or all together in one large one. Sell off all you do not intend to keep as soon as they are moulted. It is better to dispose of them at a reduced price than to keep them on for months in hopes of getting more money.

It is difficult for the amateur to learn to distinguish between male and hen in young birds. Experience alone can teach him this. The song, however, is nearly always conclusive, although instances are known, though far from frequent, of singing hens. There is, moreover, a different carriage in the male—he is neater, brighter, and bolder.

When your birds begin to moult, your object and your anxiety will bo to get them safely through it. Some first-rate breeders take little heed of the moulting season, and do not alter their usual treatment, and if a few die they do not bother. It is my own impression that birds not properly treated during the moult will not be so strong during the succeeding season. On the other hand, some people coddle their canaries far too much during moult. There is a medium in all things.

Birds are more apt to catch cold at this critical time, and if the cold strikes inwards, as the saying is, inflammation and death may ensue.

This fact ought to make us careful to keep the cages clear of draughts and free from damp. Even the room in which they hang should never be damp. The cages should be in a warm corner, and as warmth quickens the moult and causes it to be more perfect, it is a good plan to cover all the cage up except the front portion.

Do not be unmindful of the value of fresh air, therefore be careful to have the room properly ventilated every day by opening the windows at noon.

As usual, give fresh water daily, and for the first week or two a little aperient medicine may be put in the water every second day, either a small teaspoonful of carbonate of magnesia, or a little treacle. About the third week of the moult give a tonic by placing in the water a medium sized iron nail.

The food should be much as usual, only with the addition of egg and bread crumb, and any garden or roadside seeds the birds may fancy should be given. Do not forget green food, given sparingly. The bath should be allowed about twice a week. The plan of moulting birds off in dark rooms is, in my humble opinion, weakening to the system.

Every boy has heard of cayenne feeding during moult. It is a plan invented several years ago by, I believe, a noted breeder, to deepen and enrich the color of canaries. The fact that it does so is undisputed. Why it should do so no one can rightly explain; and the question whether or not it injures the constitution of the bird is a vexed one, so that we shall not enter into it. If you mean to adopt the plan, you must get the very purest cayenne that can be got. The condiment is mixed with soft food, especially with egg and biscuit crumb, the proportion being one hard-boiled egg mixed with say three small milk biscuits well grated, and a large teaspoonful of K.N.

Begin to give this about the age of six or seven weeks, when the feathers are still in the skin. Do not give very much seed at the same time. From one to two or more spoonfuls of the K.N. food may be given to each bird daily.

Saffron cake is sometimes given to birds during the moulting season, and a little syrup of saffron, about a teaspoonful, might be placed in the drinking water occasionally.

If you wish a bird to be particularly fond of you, single one out—a bright, smart, saucy male—and put it in a cage by itself. It must, of course, be young. Feed it yourself and talk much to it, and whenever it comes towards you give it a tiny bit of some dainty. You will soon have it so tame that you may open the cage door and let it out. If you take no notice of it, it will come by-and-by and perch on your shoulder, on which you may place some dainty morsel. When it retires of its own accord shut the cage door, but not before. The great secret of taming birds, or winning the affection of any animal, is summed up in one sen-

tence—Be always kind to them; let them be in every way dependent on you, but never try to force their affection.

(To be concluded.)

Amateur Boat-Building.—VI.

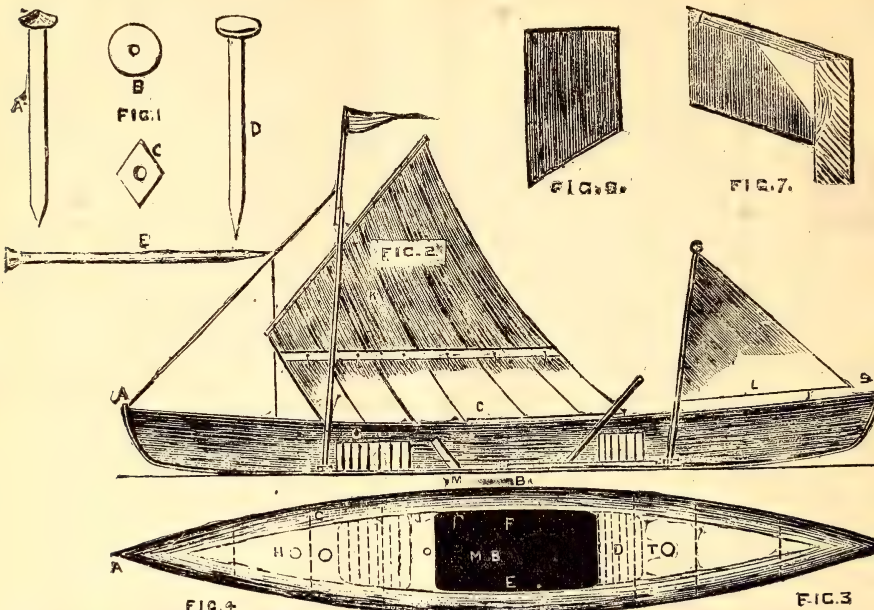
VARIOUS sizes of nails are used in boat-building, according to the particular purpose for which they are required. They are made either of copper or of iron, those of the latter metal being occasionally tinned or galvanized, but not usually. For general purposes, copper nails are to be preferred for fixing the skin of the boat, although iron nails are employed by some professional builders for light craft. The most usual form of boat nail is that shown at A, Fig. 1. This nail is square, has what is known technically as a "rose" head, tapers towards the end, and terminates blunt and square. This blunt end is found better adapted for certain purposes than if the nail were pointed. With this boat nail is used the "rove," B Fig. 1, which is a small perforated metallic disc. In fixing on the planking of the boat, the nails are driven from the outside, and are always of sufficient length to leave a portion inside the boat after the wood has been pierced. When the entire skin of the boat has been thus nailed on, a rove is slipped over the point of each nail, of which latter any superfluous portion more than is sufficient to form a good rivet is cut off by the aid of a pair of boat-builder's nippers, which cut at the ends; the remainder of the shank of the nail is then carefully riveted down with a light hammer upon the rove.

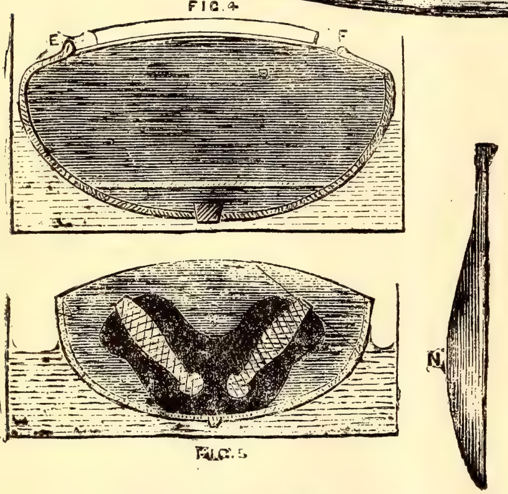
This rivetting the shank of the nail down upon the rove brings the planking close, and makes a good job. The rove is usually circular in form, as shown at B, but formerly a diamond shape C, Fig. 1, was more common. Beside the regular boat-nail, the clout-nail D, Fig. 1, is often used, the rove being dispensed with, and the portion of the end which projects inside being beaten down on the wood in the direction of the grain. and struck with the hammer, so that it sinks into the boarding. This is called clinching. If the nail projects more than a quarter of an inch, the surplus portion must be cut off, as in the case of the roved-nail. Clout-nails are square, like boat-nails, but have a flat, round head instead of a rose head. The size of the nail will, of course, depend upon the class of work for which it is to be used. From 14 to 17 gauge are employed for light craft, with Nos. 1, 2, or 3 roves. Boat nails and roves cannot often be procured of ordinary hardware dealers. Our builders may, however, get them, and all other kinds needed for boat-building by sending to this office where we will furnish small quantities to amateurs. Nails of much larger size than those specified noted in the proper place. The French wire nail E, Fig. 1, is somtimes employed for light boat-building, its tenacity rendering it very suitable for easy clinching. This is a round nail, and is used without a rove. In light work it is best to employ a fine bradawl to bore a small hole for the boat, or clout nail. The French nail (*point de Paris*) being sharp, does not need this preliminary, as there is little fear of its splitting the wood.

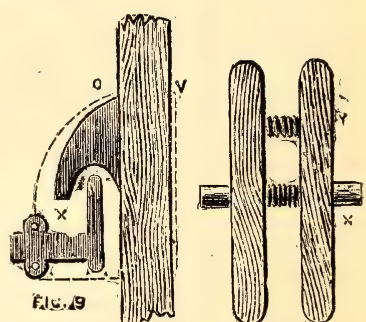
As there have been several requests from our readers for information about canoes, especially of the "Rob Roy" form, introduced by Mr. Macgregor, we will alter our original order, and devote a short space to that subject before taking up punts, skiffs, etc.

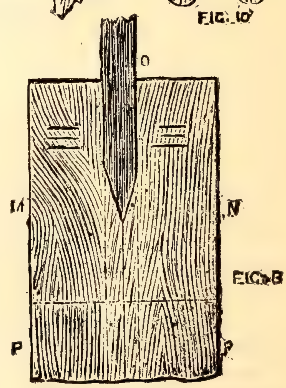
The "Rob Roy" canoe has well earned its celebrity as the best craft for general travelling purposes, and the amateur cannot adopt a better model. Several varieties and modifications have, however, been brought out since, some of which, as Alden's boat, the "Shadow," have attained considerable popularity.

Mr. Macgregor's first "Rob Roy" made a voyage of a thousand miles through France, Switzerland, and Germany; and his newer canoe navigated the Baltic, and went through much of Sweden and Norway. The "Rob Roy" was primarily—and, indeed, above all—a travelling craft, light, easily adapted to what the Canadians term "portage," or the capacity of being carried readily by land, strong, and

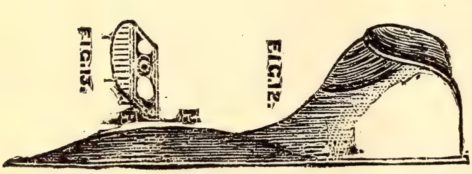








Amateur Boat-Building.



well arranged for facile paddling. The "Rob Roy," when completely fitted weighed 71 lbs. only, or without fittings 60 lbs. Mr. Macgregor considers that the stature, etc., of the canoeist is the proper regulating standard for his little craft. Thus it is the length of the occupant's foot which should determine the height of the canoe from keel to deck, the length of his leg settles the size of the well, and his weight (with travelling baggage, etc.,) governs the amount of displacement to be arranged for.

In the following description, given in great part in Mr. Macgregor's own words, a canoe is spoken of which is adapted for a man 6 feet high, 168 lbs. weight, and wearing boots whose soles are about a foot in length. The "Rob Roy" is decked, except where the canoest sits, and is built of oak, with a mahogany top streak, and a red cedar deck. The canoe has a mast which can be easily shipped or taken down, and a lug-sail. She is, of course, propelled by a double bladed paddle.

Fig. 2 shows section of the craft; Fig. 3, plan; Fig. 4, cross section at the beam; and Fig. 5, cross section at the stretcher; Figs. 10, 11 and 12, are the backboard and apron, the other sketches showing details.

The principal dimensions are: Length over all, A S, Figs. 2 and 3, 14′ from stem to stern, B, 7′ 6″; beam outside (6″ abaft midships) 2′ 2″; depth from top of deck at C, for'ard of the well, to upper surface of keel, 11″; keel, depth outside 1″ (with an iron band along the whole length ⅜″ wide); camber, 1″; depth at gunwale, 8½″. The upper streak is of mahogany, and quite vertical at the beam, where its depth is 3″. The garboard streaks, and the next on each side are light, as it is found that they are less exposed; but all the lower streaks are of oak. The stern and stem posts project over deck, so that the canoe, if turned over, will rest on these points, and on the upper end of the combing, round the well. The well is 2′ 8″ from C to D, and 1′ 8″ from E to F, so placed that D M is 2′, and thus the beam of the boat being abaft of the midships, the weight of the luggage, G, and of the masts and sails stowed forward, bring the boat to nearly an even keel. For a boat without luggage, the beam should be one foot abaft midships. The deck is supported on four carlines forward, and three aft, the latter portion being thus more strengthened, because in some cases it is required to support the weight of the canoeist sitting on the deck with his legs in the water, and each carline has a piece cut out of its end (see Fig. 7), so that the water inside may run along to the beam, when the canoe is canted to sponge it out. The after end of the carline at C is bevelled off (Fig. 6 in section) so as not to catch the leg. All the carlines are narrow and deep, to economize strength, and the deck is screwed to them with brass screws. A flat piece is inserted under the deck at the mast-hole, H, which is also furnished with a flanged brass ring. The deck is so arched as to enable the feet to rest comfortably on the broad stretcher, J, Fig. 5, the centre of it being cut down to a curve, in order that the masts and sails may rest there, and be kept above the wet under deck. The cedar deck round the well at E F, is firmly secured by knee pieces, and the boat may thus be lifted by any part, and may be sat upon in any position without injury. The floor boards about 2′ long, rest on the timbers until, at the part below C, Fig. 3, they end at P P, Fig. 8, in notched grooves, which fit into short oak pieces, M N, ¼″ thick, sloping down on each side of the keel, O, until they rest on the garboard streaks, and so lower the heels nearly 1″ below the level of the floor board on the top of the timbers.

(To be continued.)

BEARING REINS AND BLINKERS.—The *London Lancet* very sensibly argues that the bearing rein and the blinker or blinder should be abolished altogether. As regards blinkers, there are several reasons why these should be abandoned. Without them the horses are able to see the raising of the whip, and by answering thereto are saved the infliction of its stroke; their temper also is greatly improved.

The Attacus Cecropia.

BY A. W. ROBERTS.

ONE day, when wandering through the woods near the Cypress Hills Cemetery, I discovered a hedge-row of elderberry bushes on which were feeding many hundreds of young caterpillars of the *Attacus Cecropia* moth. Having my botanical collecting case with me, I filled it with leaves on which the caterpillars were feeding. At the time I write of I lived in Brooklyn, opposite the Capitoline Grounds. In these grounds, along the fencing, flourished numerous elderberry bushes. Now, here was an unusual chance to study the habits and transformations of this very beautiful creature, the *Attacus cecropia* moth, so I determined to start a cocoonery in my back yard by supplying these many hundred squirming pets of mine with a bountiful supply of fresh food every day from the Capitoline Grounds. First I captured all the glass preserving jars in the cellar. These were placed closely together in a long row; they were then filled with water, and into each jar was crowded numbers of medium-sized branches of the elder. When the caterpillars were comfortably established in their new home, I felt well rewarded for all the trouble I had taken. It would have done your heart good to see them pitch into the fresh and tender leaves of the elder. By placing my ear to the end of the fire-board on which the water jars stood, the hundreds of crunching jaws of these beautiful worms could be distinctly heard as they mowed down the succulent elder leaves. But, alas, trouble and danger came in the shape of a small and vicious looking wasp-shaped fly. I had often noticed numbers of these creatures hovering over and about my silk-worm establishment, and I began to fear that they were up to mischief of some sort. At last I caught one in the very act; I saw him dart down on one of the worms, touch him with his abdomen but for an instant, and then fly off. The caterpillar jerked his head backward to his side, as if in intense pain, at the same time drawing his body up to its smallest compass. Presently another and another worm was struck by these villainous ichneumon

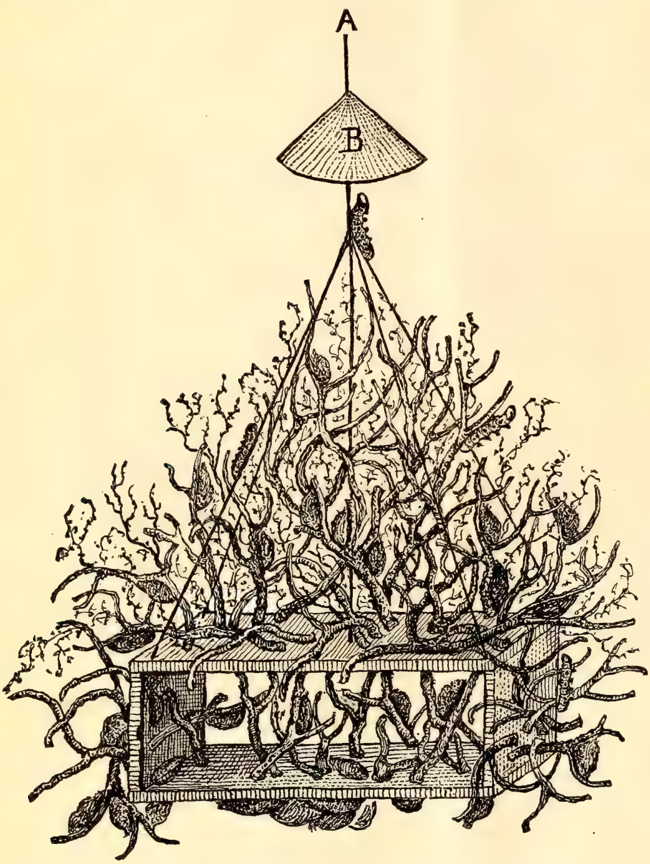


Fig. 1.

flies, for such they proved to be. Well, I knew that every caterpillar that had been struck by them would never develop into an attacus moth, though he would spin his cocoon and change into a chrysalis. This may seem contradictory, but it must be understood that when a caterpillar is struck by an ichneumon the fly drives his ovipositor deep into the flesh of the caterpillar, the result being that an egg of the ichneumon is deposited. When the caterpillar slips off his skin, after spinning his cocoon, this egg, passes into the body of the chrysalis, on which it lives. In the spring of the year, about the time the chrysalis would have changed into a cecropia moth, the now perfect larva of the ichneumon is strong enough to cut its way out of the silk material of which the cocoon is composed, and develop into a perfect ichneumon fly. To save my pets from destruction, I covered the elder branches with mosquito netting. In course of time numbers of the caterpillars began to act sluggish, and refused food, and I feared that they were sick; but such was not the case; they were going through a preparatory rest before commencing to spin their cocoons. Now I was very anxious to learn and understand all about this exceedingly interesting operation, so I devised a scheme by which I could imprison them, and at the same time have them directly under my eye. Procuring a starch box, which consisted of light wood, I withdrew the sliding top, and also removed the bottom, as shown in Fig. 1. To the upper four corners were attached four strings; these strings were gathered a yard above the box, as shown in the illustration. At the point where the four strings met was attached the single string, A, and to this string was attached a cone of heavy and highly calendered writing paper, as shown at B. The intention of this cone was to prevent the caterpillars from passing up the string A and escaping. I never knew one of my caterpillars to attempt to make his escape by dropping off from his place of imprisonment; they seemed to instinctively know they are of so fleshy a nature that such a proceeding would be certain death. Inside and outside of the box were fastened numbers of small elder branches, and on the top of the box was constructed a cone-shaped mass of the same material, which, to more securely hold it together, was tied to the four converging strings. This odd-looking structure, after being completed, was then charged with ripe caterpillars. At first they ceaselessly wandered over the branches, and up the strings to the paper cone; but at last the promptings of nature forced them to succumb, and they began to throw their silken webs, to spin their cocoons. Was I greatly interested? Well, yes. Did I reach the office late, very late, of mornings? Yes. Did my employers wonder what was the trouble? Yes, they did; and the leading editor inquired as to what new hobby I had got astride of this time? I frankly told him I had mounted and was riding tandem some two hundred caterpillars. Now, be

Fig. 2.

it known that this kindly person was the bug and botanical editor, so you can understand why my lateness of mornings was overlooked. After some thirty of the caterpillars had spun their cocoons on the elder branches, it occurred to me that it was to be regretted that a part of the great moving mass of human beings of New York City should be deprived of witnessing, enjoying, and learning a lesson in natural history by seeing this very interesting performance. And I took the circus over to F——g's seed store in Nassau Street, and hung it up in the window, just for the fun of it. The thing hadn't been on exhibition more than an hour before a messenger was at the office urging me to come and see Mr. F——g immediately, and that the front of his store was blockaded with people standing and looking at it, and that the policeman on that beat was trying to keep the sidewalk clear. Also, that they had forgotten the scientific name of the creature, and what would I sell them for apiece on the sticks? So I wrote out a label, giving the scientific name in large and plain letters, with a short history of the beautiful moth, and also attached to the label a magnificent mounted specimen of the attacus, stating the price of the cocoons to be fifteen cents each. In the afternoon, greatly to my surprise, twenty of the cocoons had been sold. My not seeming greatly rejoiced over the financial turn the exhibition had taken, F——g remarked "What's the matter, don't you want to sell them?" "No," I replied, "I wanted to keep them; I didn't suppose there was any demand for them. I brought them over to your store as a novelty, and to attract attention to your place of business. "Well," he replied, "they have attracted too much attention; the sidewalk has been constantly blocked, and half the time my clerks have not been able to put up our goods, from people constantly coming in and asking questions. Now I'll strike a bargain with you. I'll give you a hyacinth, tuberose, or gladiolus bulb for every cocoon that I sell, and that you are to keep up a constant supply of the caterpillars." To this I at once agreed. My friend F——g sold a great many of them, and I had a most satisfactory collection of bulbs in my garden next spring. I have always found a good demand for the cocoons of all the attacus family of moths. Such being the case, why don't some of our enterprising young readers go into the thing, not only for pleasure and profit, but also to take a lesson in silk culture, a subject that is attracting so much attention at the present time. I am of the opinion that by careful cultivation and selection, our native silk producing moths will eventually be found to be of great value. In Japan and China they utilize the silk of the cecropia for the manufacture of fabrics; then why not here?

Hints from India.

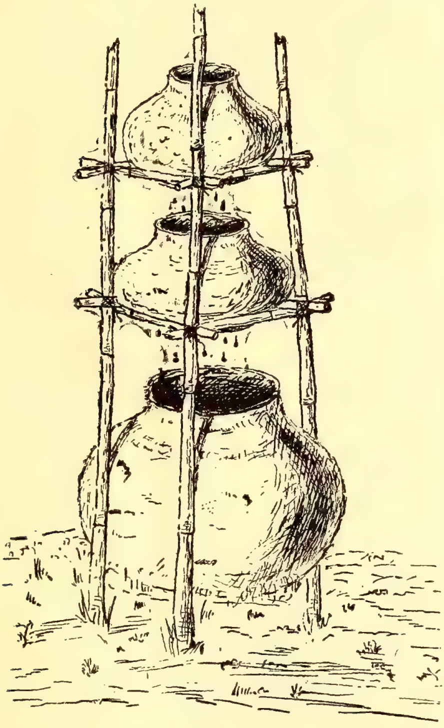
BY W. L. D. O'GRADY.

SCREEN DOORS.

IN India, most houses resemble Washington's Headquarters at Newburg in one respect. They have more doors than windows. Circulation of air is so necessary in the torrid climate that these doors are invariably left open; but in order to baffle too inquisitive eyes while not interfering with ventilation, they are supplemented by double screens, or half-doors, as they are called, which are hung just as we hang wire doors in summer, to keep the flies out and let in the air. They are light frames, covered with prettily painted paper, or chintz, or silk, and are about six feet long, reaching to about seven feet high, and leaving about a foot below, which sometimes has a valance to it, but is better without. In the lofty rooms, so characteristic of Anglo-Indian architecture, the effect of these light, graceful half-doors is very pleasing. They would be quite suitable for summer use here, and might be made quite inexpensively. No springs are needed, though of course such American improvements might be added, at some additional cost. The most stylish people in India are content with a simple slide, usually quite plain, which may, however, be elegantly carved.

CHEAP FILTERS.

The water in even the most picturesque well is sometimes anything but wholesome to drink. Filters are now recognized as among the necessaries of life. Most filters, however, of any reasonable size are rather expensive. In India a very cheap filter is used, which is practically as good as can be made, holds a large supply of pure water and cools it almost to freezing point—at any rate to a very refreshing degree of coldness, without the danger in it that lurks in ice water. It is made of bamboo, in the shape of a scaffold, with three or four large *chatties*, or



bulbous porous earthenware vessels, one above the other. The upper ones have holes at the bottom stuffed with rags, through which the cleansed water drips. The top one is half-filled with layers of coarse charcoal and pebbles, those next with the same, only finer. The bottom receptacle is usually surrounded with wet straw, and a straw mat to keep the spherical bottoms steady is supplied to each. All are thickly covered with a dew exuding through the sides, and by the evaporation cooling the contents. Such a filter in India costs about twenty-five cents. A good imitation, with very large unglazed flower-pots, instead of the *chatties*, could be made here, at a not very alarming advance on that sum. A corner of the cellar or woodshed might well be spared for such a filter.

Our Guessing Column.

BY A. W. ROBERTS.

NUMBER 1.—Who would ever imagine that money could be made by the sale of such a looking creature as the one referred to in this guess.

Nevertheless, I know of a young man who raises these insects by the thousand every year, and by the sale of them earns sufficient money to buy all his clothing. These creatures are to be had only in certain stores, and cost fifty cents a hundred. They are raised on bread, crackers, Indian and oat meals. To keep them warm and clean, they are placed between layers of blanketing. The parents have wings, and fly from place to place in search of food.

Now, my Yankee guessers, what can this insect be?

No. 2.—Once upon a time I met an old and very talkative German. In a large basket he carried a number of small glass jars, and in each jar was a pretty little wooden ladder, and on each ladder sat a quaint and very wise-looking animal in a gray suit. The expression of his eyes was particularly mild and soft. I knew this animal the moment I saw him, for when a boy I had caught many of them as they sat on the branches of trees, trilling their soft voices to one another. Now comes a curious fact about these creatures, which is, that when there is going to be a storm they climb to the topmost step of their ladders and send forth trill after trill—for they seem to delight in rainy weather.

The German charged two dollars for each jar and its contents. He informed me that for many years he had done nothing else, and that he had sold a great many. Now, my merry puzzlers, puzzle this out if you can.

No. 3.—Passing along Fourteenth street one clear and sunny day, I met a man who had for sale a number of "tame yellow birds," as he called them. It is true they were yellow birds, and would perch on his fingers or on his head, and would not attempt to fly away. Yet *they were*

not tame, nor were they sick, as they were very active, and seemed to enjoy themselves heartily.

Now, my young bird lovers, solve this mystery.

No. 4.—Early one dark morning, when crossing the City Hall Park, I was surprised and puzzled as to what a number of human beings were in search of at so uncanny an hour. Each person had an empty fruit can in his hand, while with the other he every now and then seemed to clutch at something in the short and scanty grass. After watching them for a time, I failed to reach a conclusion as to what they were seeking for, as they crept about on the ground in so stealthy and cat-like a manner. At last, overcoming my modesty, I boldly approached one of the seekers, and inquired of him why he was crawling on all fours. He told me why, and I asked him what for. He answered "For my rum in the morning."

Inquiring of another creeper, he answered, "For my pet in the morning."

Asking of another, he answered, "To obtain a breakfast for my wife and children in the morning."

What could be the object which these many human beings so eagerly sought on hands and knees? one for rum and misery; another from a strong attachment, and a third for the love and affection he bore his wife and children?

Fun From the Classics.

BY AN "OLD BOY."

REALLY, boys seem to take more interest in Greek and Latin than I thought possible. If we are to believe what certain educationists tell us, the study of the classics is rapidly dying out at school. Well, it may be so, but at any rate it is not defunct yet, for no one can find any pleasure in deciphering a macaronic or construing a puzzle who has not made some acquaintance with ancient authors. And that there are some who have found amusement in these studies I have reason to know.

A friend reminds me that we have not yet had *Pugno pugnas pugnavi*, a very old friend: "I have fought battles with my fist." This is tolerably easy; but which of you can construe the following:

"Carmina, carmina, carmina, carmina, carmina multa,
Carmina multa rogas: carmina multa dedi"?

The lines are supposed to have been written by a cheeky Etonian in reply to an exacting tutor. They are decidedly ingenious.

I have lately met with some very good macaronics: one, from which I will give an extract, is in an ancient number of "Punch," and is entitled, "The Death of the Sea Serpent, by Publius Jonathan Virgilius Jefferson Smith":

"Arma virumque cano, qui first, in the Monongahela,
Tarnally squampush'd the Sarpint, mittens horrentia tela.
Mighty slick were the vessel progressing, jactata per æquora ventis:
But the brow of the skipper was cloudy, cum sollicitudine mentis."

However, whilst bewailing their bad luck—

"He saw coming towards them, as fast as though to a combat 'twould tempt 'em,
A monstrum, horrendum, informe (cui lumen was shortly ademptum).
On the taffrail up jumps in a hurry dux fortis, and seizing a trumpet,
With a blast that would waken the dead, mare turbat et aëra rumpit—
'Tumble up, all you lubbers,' he cries—
'tumble up! for careering before us
Is the raal old Sea Sarpent himself, cristis masculisque decorus!'"

The epic goes on to relate how they lowered the boat and attacked the monster, who turns on them:

"But the bold skipper exclaims, 'O terque quaterque beati!
Now with a will, dare viam, when I want you be only parati!'"

Dare viam for "give way," is very fine.

He finally overcomes the serpent with a lance which *ad intima viscera mittit;* and the skipper's cry,

"'We've fixed up *his* flint, for in ventes vita recessit,'"

closes the poem.

Professor Smith, of the Blind Asylum at Louisville, Kentucky, wrote the following when a student at Yale College:—

(1) Felis sedit by a hole.
Intenta she cum omni soul,
Prendere rats.
Mice cucurrerunt over the floor,
In numero duo, tres, or more,
Obliti cats.

(2) Felis saw them oculis;
I'll have them, inquit she, I guess,
Dum ludunt.
Tunc illa crept toward the group,
Habeam, dixit, good rat soup,
Pingues sunt.

(3) Mice continued all ludere,
Intenti they, in ludum, vere
Gaudenter;
Tunc rushed the felis unto them,
Et tore them omnes limb from limb,
Violenter.

MORAL.

Mures ! omnes mice ! be shy.
Et aurum praebe mihi
Benigne.
Si hoc facis—verbum sat—
Avoid a huge and hungry cat
Studiose.

Let me give you a verse from a poem on Æstivation, supposed to have been written by a Latin tutor immured in a town during summer. Those who want the whole must look in Holmes's "Autocrat of the Breakfast Table" for it.

"In candent ire the solar splendor flames ;
The foles, languescent, pend from arid rames ;
His humid front the cive, anheling, wipes,
And dreams of erring on ventiferous ripes."

This is splendid. At first it looks like one of the poems out of "Alice in Wonderland":

"'Twas brillig and the slithy toves," etc.,

but when looked at more carefully it will be seen that the peculiarity consists in treating Latin words as English ones, not mixing the two together, as in the ordinary macaronic.

To finish with, we will have a few genuine pieces of translation by juvenile criminals—criminals in a literary sense only. There is a well-known sentence in Henry's Latin book, which runs, "Sagittae ab humero pependerent." "Pro causa troublam savendi," as "Punch" puts it, a boy treated "sagittae" as a proper name, with this result, "They hung Sagitta by his shoulder."

I have in my possession a recent number of the "F—— School Magazine" (I will be merciful, and not give the full title). The lower school has evidently been at work on Virgil, with the following results, as shown in examination papers:—

"Parvam te roscida mala vidi cum matre legentem" (Buc. viii. 38).

This was translated, "I have seen you, a not large girl, reading apples with your mother."

There is no doubt that this is terribly funny, but I can't help being rather angry with the boy who has so burlesqued one of the exquisite passages of the Bucolics. "Gathering the dewy apples" turned into "reading apples." O shade of Virgil!

"Frigus Captabis opacum"—"You will catch a heavy cold." Those who remember that the passage begins "O fortunate senex!" will appreciate the exquisite fitness of the translation.

"Flumine libant, summa leves" (Georg. iv. 54-5). The Editor of the magazine remarks, "The last two words were given with the peculiarly felicitous translation of 'summer leaves.'" I hope, by the way, that the examination papers did not contain the same errors as the magazine, or I could almost forgive the boys who failed to make sense of the passages. "Oviscus tos" for "Oves custos" is enough to put a scholar out, not to mention a boy who is capable of writing "red with the scarlet berries of the ivory," or "the strange sheep milks its guardian twice an hour."

Famous Popular Songs.

"AULD LANG SYNE" is popularly supposed to be the composition of Burns; but, in fact, he wrote only the second and third verses of the ballad as commonly sung, retouching the others from an older and less familiar song. "The Old Oaken Bucket" was written by Woodworth in New York city during the hot summer of 1817. He came into the house and drank a glass of water, and then said, "How much more refreshing it would be to take a good long drink from the old oaken bucket that used to hang in my father's well." His wife suggested that it was a happy thought for a poem. He sat down and wrote the song as we have it. "Woodman, Spare that Tree!" was the result of an incident that happened to George P. Morris. A friend's mother had owned a little place in the country, which she was obliged from poverty to sell. On the property grew a large oak, which had been planted by his grandfather. The purchaser of the house and land proposed to cut down the tree, and Morris' friend paid him $10 for a bond that the oak should be spared. Morris heard the story, saw the tree, and wrote the song. "Oft in the Stilly Night" was produced by Moore after his family had undergone apparently every possible misfortune. One of his children died young, another went astray, and a third was accidentally killed. "The Light of Other Days" was written to be introduced into Balfe's opera, "The Maid of Artois." The opera is forgotten, but the song still lives, and is as popular as ever.

Payne wrote "Home, Sweet Home," to help fill up an opera he was preparing, and at first it had four stanzas. The author never received anything for it; but, though the opera was a failure when played in the Covent Garden Theatre, the song took, and over one hundred thousand copies were sold the first year. In two years, the publishers cleared over $10,000 by the publication; and the variations, transcriptions, and imitations have been innumerable. The melody is believed to be a Sicilian air, and Donizetti has a variation of it in his opera Anna

Bolena. Payne was afterward appointed American Consul at Tunis, where he died, and whence his remains quite recently were brought to America. Some of his miseries may be guessed from his own words: "How often have I been in the heart of Paris, Berlin, London, or some other city, and have heard persons singing or hand-organs playing 'Home, Sweet Home,' without having a shilling to buy myself the next meal or a place to lay my head. The world has literally sung my song till every heart is familiar with its melody; yet I have been a wanderer from my boyhood, and in my old age have to submit to humiliation for my bread." Foster's "Old Folks at Home" was the best song he ever wrote. Over four hundred thousand copies were sold by the firm that first published it, and the author is said to have received $15,000 for his share in its sale. Christy, the noted minstrel, paid $400 for the privilege of having his name printed on one edition of "Old Folks at Home" as the author and composer. The song is thus often erroneously attributed to him. "Rock me to Sleep" was written by Mrs. Allen, of Maine. She was paid $5 for it; and Russell & Co., of Boston, who had in three years gained $4,000 by its sale, offered her $5 apiece for any songs she might write. Some years after, when a poor widow and in need of money, she sent them a song, which was promptly rejected. "A Life on the Ocean Wave," by Epes Sargent, was pronounced a failure by his friends. The copyright of the song became very valuable, though Sargent never got anything for it himself. "What are the Wild Waves Saying?" was suggested to Dr. Carpenter by a scene from Dickens' novel, "Dombey and Son," and the music was by Glover. "Poor Jack" was from the pen of Charles Dibden, the author of the Lamplighter. "Poor Jack" netted $25,000 for its publisher, and almost nothing for its author. "Stars of the Summer Night," a very famous song, especially for serenaders, was written by Alfred H. Pease, the noted pianist, whose sad death in St. Louis a few months ago was so greatly deplored by his friends. "Love's Young Dream" was one of Moore's best, but the tune to which it is commonly sung is from an Irish ballad called "The Old Woman." Moore sang his own songs so well that both his auditors and himself were often moved to tears. Once, when he was singing this song, a lady who heard him implored him to stop. "For heaven's sake, stop! This is not good for my soul." "Auld Robin Gray" was the work of Lady Anne Lindsay, who tells a curious story of the circumstances of its composition: "I called to my little sister, the only person near, and said, 'I have been writing a ballad, my dear. I am oppressing my heroine with many misfortunes. I have already sent her Jamie to the sea, and broken her father's arm, and made her mother fall sick, and given her Auld Robin Gray for a lover, but I wish to load her with a fifth sorrow within the four lines, poor thing. Help me to one.' 'Steal the cow,' said the little Elizabeth. The cow was immediately lifted by me, and the song completed." "Kathleen Mavourneen" was sold by Crouch, the author, for $25, and brought the publishers as many thousands. Crouch was hopelessly improvident, and in his latter days became a tramp. When Mme. Titiens was in this country a number of years ago, she sang "Kathleen Mavourneen" in New York, when a dirty tramp introduced himself as Crouch, was recognized, and thanked her for singing the song so well. "Bonnie Doon" was the only English song that the Emperor Napoleon liked. "I'll Hang my Harp on a Willow Tree" is said to have been written by a young English nobleman in love with Princess (now Queen) Victoria. "Annie Laurie" is two hundred years old, and was the production of a man named Douglass, to celebrate the praise of a girl named Laurie. The lady afterwards deserted the man who made her famous, and married a man named Ferguson.

A Beautiful Python.

IN the Zoological Gardens, London, can now be seen in all the velvety sheen of its first splendor, a python that has just cast its skin, and the great snake is a very miracle of reptillian loveliness. Not even the birds of paradise can compare with its purples, blues, and gold, while an infinite interest underlies those iridescent charms, from the fact that its coils, soft as a butterfly's wings, and shot with colors like a dove's breast, can crush the life out of a strong man, can hold the tiger in its range, and slowly squeeze it into pulp. Watch its breathing; it is as gentle as a child's. And the beautiful lamia head rests like a crowning jewel upon the softly heaving coils. Let danger threaten, however, and lightning is hardly quicker than the dart of those vengeful convolutions. The gleaming length rustles proudly into menace, and, instead of the voluptuous, lazy thing of a moment ago, the python, with all its terrors complete, erects itself defiantly, thrilling, so it seems, with eager passion in every scale, and measuring in the air with threatening head the circle within which is death. Once let those recurved fangs strike home, and, though there is

no poison in them, all hope is gone to the victim. Coil after coil is rapidly thrown round the struggling object, and then, with slow but relentless pressure, life is throttled out of every limb. No wonder that the world has always held the serpent in awe, and that nations should have worshipped, and still worship, this emblem of destruction and death. It is fate itself, swift as disaster, deliberate as retribution, incomprehensible as destiny. Gods and heroes alike held victory over the snake as the supreme criterion of valor. They graduated to divinity by slaying serpents. Indra and Vishnu conquer snakes. Hercules and St. George have their hydra, Apollo his python. It is over the body of Ladon, terrible progeny of a terrible parentage, Typhon its father and Echidna the dam—that the hero steps to gather the golden apples, and across the dead coils of Fafnir that Sigurd reaches out his hand to the treasurers of Brunhild on the glistening heath. What more fearful in Oriental myth than Vritna the endless thing that the gods overcome, or Kalinak, the black death, or Ahi, the throttler? Jason and Persens, Feridun and Odin claim triumph over the snake as their chiefest glories, and it would be tedious to recapitulate the multitude of myths through which "the dire worm" has come down to our times dignified and made awful by the honors and fears of the past. The python in the Zoological Gardens, however, though it may stand as the modern reality of the old-world fable of a gigantic snake that challenged the strength of gods to overcome it, presents to us only one side of the snake nature, surprising beauty and prodigious strength; but it is not venomous. Probably the more subtle and fearful apprehensions of men originated really from the smaller and deadlier kinds, and were then by superstition, poetry, and heraldry extended to the larger. The little basilisk crowned king of vipers; "the horned cerastes dire," a few inches in length; the tiny aspic, fatal as lightning and as swift; and the fabled cockatrice, that a man might hold in his hand, first made the serpent legend terrible; their venom was afterward transferred, and not unnaturally to the larger species. It was the small worms, that carried in their minute fangs such rapid and ruthless death, which first struck fear into the minds of the ancients, and invested the snake with the mysterious and horrid attributes whereto, antiquity, from China to Egypt, hastened to pay honor. Of the venomous snakes the Zoological Gardens presents many very fearsome examples, and painful death, such as science is as yet powerless to arrest, lurks within half the cases in the reptile-house. Eminent among the most deadly is the surucurn of the Brazils. Every one knows of the fatal daboia of India and the cobradi-capello, the rattlesnake, the ophiophagus, and the other more familiar reptiles with poison fangs, all of which are to be seen in Regent's Park; but the stranger from South America is their rival in the certainty and rapidity of the death that it inflicts. It and the python, therefore, may take rank as the representative of the two aspects of the snake idea in nature.

Camping Out.

THOSE who can afford it, take their summer vacation at the sea-shore or at some mountain resort. The object in selecting a locality, aside from those who are governed by fashion, being to find a place with surroundings as much unlike those at home as possible. But those who need the summer visit to sea-shore and mountain side, the farmers' and mechanics' hard-worked wives and families, can rarely afford the outlay required. A week at any of these public resorts involves an expenditure that is beyond the means of the majority. After all, the real objects of summer vacation is, change—a change of scene, a relief from the daily routine of household duties, a freedom, for the time, from care, and often a marked difference (sometimes for the worse) in the food. Besides these objects, there may be added the meeting with new people, and seeing new ways, which may or may not be desirable. All these results, save the last, can be had without expense, by a week or two in camp. A neighborhood must be poor, indeed, if it does not somewhere within a few miles, afford a pleasant spot for a camp. It may be by the side of a lake or a river, where fishing can be enjoyed; a hill-side or a mountain top may afford a pleasant place. A desirable spot can usually be found not far from home—indeed, we know of one farmer who does not go beyond the boundaries of his own estate to find a pleasant camping ground. If tents are not at hand, wagon covers, barn sheets, tarpaulins, or whatever will form a shelter from the dew and rain, may be pressed into the service. The chief point is have an abundance of bedding; buffalo robes and comforters, and a plenty of blankets, are usually sufficient, though some may need ticks filled with straw. In starting out for camp, do not take too many things. One of the useful lessons of camp-life is, to show how little one can get along with. The most important part of the outfit is, an abundant supply of good nature; a disposition to

make the best of everything, to overcome difficulties and be always cheerful. A grumbler is an unpleasant companion anywhere, but in camp he is a nuisance. In warm weather, the camp-fire should be at a good distance from the sleeping tents, and precautions taken that no spreading of the fire can occur. It is well to leave nearly all of the crockery at home, and provide a supply of tin plates, tin cups, and cheap knives and forks. Prepare in advance sufficient food to serve for the first two or three days, and then be governed by circumstances.

If the locality furnishes fish or game, the procuring of these will afford sport for the men and boys, but it is not safe to depend upon these, and there should be in reserve a ham, a supply of the standard camp-food, salt pork, which, with an abundance of potatoes, hard-tack, dried apples, and coffee, will keep the table well furnished. Have meals at stated hours, let each one in his or her way help in preparing them, and—what is still more important—help in clearing away and washing dishes. Keep the surroundings of the camp in good order. Have a pit in a convenient place for scraps and slops, and provide other conveniences in a sheltered place at a proper distance. If guns are taken into camp, let it be the business of some one to provide a proper place for them beyond the reach of children, and where no accident can occur. See that the guns are always kept there when not in use. Reduce the work to the smallest possible amount, so that the greater part of the day may be spent in rest—in "leisure," in the best meaning of the term. Be sure and provide an abundance of reading matter. Any hard-worked family will return from a fortnight's vacation, or a longer one, of this kind, better fitted to take up the home routine, and perhaps be more appreciative of home comforts.—*Agriculturist.*

The Modern Canoe.—Masts and Sails. Cooking Utensils and Food Carried in a Small Space.

"THE primeval canoe has passed through a process of evolution," said a manufacturer of light water craft. "The crude dugout was gradually improved upon until it resulted in the Indian's birch bark canoe. This was a fast and serviceable craft, but it was very far from being comfortable. The paddler sat on a wooden rod, instead of a seat, and the canoe was very cranky. By gradual development the Indian canoe has been made into the canoe of to-day. Cruising canoes are the most popular. The American Canoe Association has decided that a canoe to be entered for races must be a boat sharp at both ends, and not more than thirty-nine inches wide on deck. She may be propelled by sails or paddles, or both, but she must be capable of being effectually propelled by a double-bladed paddle. The best canoes have air chambers at the ends, which will float the crew and cargo even if the canoe is stove in. Canoes usually have the keel, bottom, and stem and stern posts of oak, while the sides and top are of cedar. The ribs are of red elm, and the coamings of oak. They are copper fastened throughout, and finished with oil. Bulkheads are built forward of the cockpit for dry storage. The craft is steered by the feet of the paddler by means of a simple steering gear. A canoe to be complete needs a various equipment. The fittings for the canoe itself are a rudder, steering gear, a cushion, backboard, paddles, masts, spars, sail, ropes, blocks, and cleats. One of the most popular models has the following dimensions:—Length, 14 feet; beam, 26 inches; depth amidship at gunwales, 8 inches; at ends, 13 inches; rise of deck, 3 inches; cockpit, 18 by 60 inches."

"Where are canoes built?"

"Many boat builders will turn out a canoe when ordered, but the best are made by special canoe builders. The demand for them has increased so much during the past five years that there are several large canoe yards scattered around the lake regions. Centreboard canoes are quite popular. They average 15 feet in length, and are made very stiff. They are completely equipped with masts and sails that can be unshipped and stowed away when the voyager paddles. There is no end to the things a canoeist needs when making a cruise, and enthusiasts are constantly at work perfecting little labor and space saving devices. There is a place in a well-run canoe for everything that is needful for comfort, and every thorough canoeist keeps everything in its place.

"One of the most recent of the many contrivances is a sort of housekeeper's box, which is made to fit in a special locker in the canoe. It consists of a light tin box 8 by 12 by 5 inches, divided into compartments. One section has three movable trays for bacon and crackers. Next are two boxes for oatmeal and rice respectively. Then there is a large box for flour. Next is a compartment in which can be packed three pails, a fryingpan, a saucedish, a boiler, and some small tin pie plates. All these utensils are made so that they fit into each other. The four corners of the main box are for pepper and salt. In the middle of the whole thing is a place for ice, with a compartment for butter next to it. All this

takes up considerably less than a cubic foot. Then there are perfectly made stoves, all complete, which can be packed in a space of about 10 inches square. A modern canoe carries every necessary for a cruise in a remarkably small space. It is not to be wondered at that canoeing is popular."—*Albany Journal.*

Coleoptera.

BY MARY H. WHEELER.

In the field of a farmer a young student strayed,
And in language of science most bland,
He soliloquized thus of the specimens laid
In a box which he held in his hand:

"The antennæ geniculate, here at the joint,
And the head is prolonged like a snout;
To the tribe of *Rhynchophora* that seems to point,
Yes, and there it belongs, without doubt.

And in this the elytra are yellow and black,
With the striæ just five on each sheath;
And the large under wings lie close down to its back;
Mesosternum points forward beneath;

The prothorax is spotted and covered with dust,
And the mandibles move with some force;
Can it be the *Doryphora?* Surely it must—
The *decem-lineata*, of course."

The old farmer was standing a moment to rest,
With his arm round the horn of an ox,
With the large-sounding words he was greatly impressed,
And he looked in the scientist's box.

Then he laughed a haw! haw! and a merry ha! ha!
And he bent and he shook with his laughter.
And the echo that dwelt in the hillside afar
Caught the sound and repeated it after.

And he said, as the student looked on in surprise,
"Now, stranger, I mean ye no evil,
But to think of your holding, while talking so wise,
A potato-bug, there, and a weevil!"
And he laughed and he shouted, with tears in his eyes,
"A potato-bug, oh! and a weevil!"

Pittsfield, N. H.

—Human foresight often leaves its proudest possessor only a choice of evils.

—There is nothing more universally commended than a fine day; the reason is that people can commend it without envy.—*Shenstone.*

Our Girl's Department.

This department is intended exclusively for "Our Girls," and we hope to make it both interesting and instructive, and to this end we ask our young lady readers to assist by contributions, suggestions, or illustrations. There are thousands of little things that can be, and have been, made and done by young ladies, pertaining to decorative art, needle-work, etc., etc., that would be gladly followed but for a want of knowledge on the subject, and we know of no more pleasing task for a lady than that of teaching her younger sisters that which they are anxious to learn, and which may prove of real benefit to them in the future, as well as being useful and interesting for the present. We trust we will have no difficulty in persuading those who have something nice to show or speak of, to make use of this department. Remember, it is open to all, and if you have anything worth knowing suitable for this column, send it along, and we will give it our best attention. Do not be afraid to write because you may fancy your composition is not perfect, or have other scruples of a similar kind. Do the best you can, and leave the rest to the editor of this department, and we are sure you will be pleased with your work.

—There lies across the mother's knee,
And gathered in her hand,
A little robe of puffs and lace,
With an embroider'd band.
I see her smile, I hear her sing
A low, sweet lullaby;
And oft, I see a thought of joy,
Light up her bright blue eye,
It is a robe for her dear child
To be christen'd in!

There lies across the mother's knee,
And gather'd in her hand,
A silken robe, with puffs of lace,
And an embroider'd band.
'Tis white, and like a cloud at eve,
That floats across the sky;
But oh, I hear the mother give
An oft repeated sigh.
It is a robe for her dear child,
To be wedded in.

There lies across the mother's knee,
And gather'd in her hand,
A robe of softest wool; but it
Has no embroider'd band.
And on her cheeks so wan and pale,
The mother's tears I see,
And hear her pray, Lord, give me strength!
Oh! give Thy strength to me!
It is a robe for her dear child,
To be buried in!

—To rule one's anger is well; to prevent it is better.—*Edwards.*

—He who foresees calamities suffers them twice over.—*Porteus.*

— Censure is the tax a man pays to the public for being eminent.—*Swift.*

— Experience, joined to common sense,
To mortals is a providence.
—*Green.*

— He is the best accountant who can cast up correctly the sum of his own errors.—*Nevins.*

— Rest satisfied with doing well, and leave others to talk of you as they please. —*Pythagoras.*

— Affliction is the good man's shining scene;
Prosperity conceals his brightest ray;
As night to stars, woe lustre gives to man.
—*Young.*

— Disparage and depreciate no one; an insect has feeling and an atom a shadow. *Coleridge.*

— Education begins the gentleman, but reading, good company, and education must finish him.—*Locke.*

A grateful mind
By owing owes not, but still pays; at once
Indebted and discharged.
—*Milton.*

Any one may do a casual act of good nature, but a continuation of them shows it is a part of the temperament.—*Sterne.*

— We should never make enemies, if for no other reason, because it is so hard to behave toward them as we ought.—*Palmer.*

— Singular that the word miser, so often expressive of one who is rich, should in its origin, signify one that is miserable.—*Browne.*

— Receive no satisfaction for premeditated impertinence; forget, forgive it, but keep him inexorably at a distance who offered it.—*Lavater.*

— The country is the philosopher's garden and library, in which he reads and contemplates the power, wisdom, and goodness of God.—*Penn.*

— Affectation in any part of our carriage is lighting up a candle to our defects, and never fails to make us be taken notice of, either as wanting sense or sincerity.—*Locke.*

— There cannot live a more unhappy creature than an ill-natured old man, who is neither capable of receiving pleasures, nor sensible of doing them to others.—*Sir W. Temple.*

— If a man does not make new acquaintances as he advances through life he will soon find himself left alone. A man should keep his friendship in constant repair.—*Johnson.*

— It is doing some service to humanity to amuse innocently: and they know very little of society who think we can bear to be always employed either in duties or meditations without any relaxation.—*Irving.*

— A contented mind is the greatest blessing a man can enjoy in this world; and if in the present life his happiness arises from the subduing of his desires, it will arise in the next from the satisfaction of them.—*Addison.*

— The grandest treasure it is possible for man to possess on earth is a good wife. The poorest investment he can ever make is a worthless one. Personal adornment may please the eye of the vulgar, but it will not hide a false heart. Sin may cloak itself for a brief season in the garment of hypocrisy, but sooner or later it shall come to judgment. Pure affection is a priceless jewel, the embodiment of earthly bliss. In the true union of husband and wife money should not enter into the consideration. The happiest homes the world ever knew have been bought and paid for by mutual earnings after marriage. The good and true wife adorns her home and makes it a little heaven. It is the abode of a royal family, a king and queen dwell within. There are no false gods in such a household.

— Well is it for the woman who is shielded and guarded through life. There are many lovely qualities to be developed only in such a protected condition. But sudden changes are injurious in propor-

tion to the delicacy of the organization. The old simile of the woman and the plant holds good in that respect. It is probable that, with the most favorable development of freedom, women will always be inferior in judgment to men; always more liable to make fatal mistakes in the conduct of life. If they are to be always under guardianship, let there be always a guardian. If they are to have responsibility, that doubtful good, let them as far as possible be fitted for it. Do not rely too much upon your daughter's good sense, fond parent. Your boy may do unwise and even wicked things, and may be a grief to you for a time, and yet go back and begin an honest life and be honored and happy, and all the past is forgotten; but your girl may do no wrong thing at all, and yet entangle herself so that she is unhappy and out of place for the rest of her days. It lies with no parent to insure happiness for his children. That is true. But in the large number of cases much may be done to lessen the probability of misfortune. Watchful care does not mean lack of trust, and native good sense is not ill supplemented by an education that teaches the girl something of the conditions in which she will be called upon to act.

— Two gentlemen, at a large reception in New York last winter, were discussing one of the foremost politicians of the country—a man who, whether in office or out, always keeps himself prominently before the public. "I knew him at college," said one of the gentlemen. "He was a man with a clear head, extraordinary memory, and much personal magnetism. But I cannot understand why he chose a public life or has pushed himself forward so persistently. He was a lazy, thoughful, visionary fellow, absolutely destitute of ambition." "I can tell you the secret," said the other. "You will find it in his wife's nose. There she is! did you ever see a more perfect incarnation of energy and love of command? Napoleon would have chosen her for one of his Marshals at first sight." His friend was amused at the guess, and said, presently:—"There is another of my old class-mates, P. He was a thin, ambitious, scholarly fellow, with refined tastes and high aims. He now is a fat, indolent animal, without a thought, apparently, but his cognac and terrapin. Who is to blame for that?" "His wife's mouth and her money. I will show her to you." He pointed out a gross, voluptuous woman, richly dressed. "P.," he resumed, "has lived in idleness since his marriage. He was not strong enough to carry the weight of so much wealth and so much vulgarity. They have borne him down. He will never rise." Young men at school and college are very apt to be enraptured with a sparkling eye, a rosy cheek, or some charm of manner in some young woman that they happen to meet. They are hardly masters of themselves; and a moonlight night, or a song, suddenly tempts them to ask the enchanting creature who has bewitched them to share their future. They do not consider that she will be the most real, active force in their whole lives, almost irresistible, with power to drag them down or to lift them up in body, mind, and soul.

— That was an unprecedented wedding, the recent one in Paris, of Rothschild's daughter to the banker Ephrussi. Over two thousand of European *elite* witnessed it, the array of dress, jewelry and beauty being bewildering. The splendid synagogue was Orientally draped in crimson and gold, rare exotics, growing fruits, and ravishingly odorous flowers abounding. The scene was one of rare magnificence. The bride drove up in an armorial carriage drawn by two splendid bays, a hum of admiration greeting her pageant. On entering the synagogue the males who were not Hebrews removed their hats, but were reminded by the *hussiers* that their people always remained covered in the temple and supposed presence of Jehovah, just as the favored Spanish grandees remained covered in the presence of their king. Two hours were consumed in the ceremony, the Grand Rabbi of France and the Grand Rabbi of Paris officiating; during it the retinue several times changing her trousseau. To gratify our lady readers, we

will tell them that the bride is but eighteen years of age, of medium height, slight and graceful form, a winning, pleasant face, transparent complexion, "a daisy" of a mouth, brilliant hazel eyes, and a wealth of brownish hair. She wore at first a dress of white satin with a very long train; this terminated in three points, the centre one being trimmed with orange blossoms. Her veil was of *point a l'aguille* lace. Among the splendid dresses she wore the most noticeable was a cream-colored velours epingle, with a very long train, the front of draped crepe, with the same color around the train, which had a wide border of variegated vine leaves, the tints ranging from dark green to russet red. The leaves were of velvet. On the left side of the jupe was a large cluster of velvet leaves. The corsage was pointed and decollete, trimmed with a garland of vine leaves. The wedding presents, in their multitude, beauty, usefulness and value, the local scribes say, defied description. One painful, heartrending fact, however, is dwelt upon, which is that among them was a *caveaux* from the baron father to the bride daughter of three hundred thousand dollars to furnish house with, and five thousand dollars per month with which to keep it. It is said that during the ten days preceding the wedding the bride received over 1,100 letters from destitute young ladies asking alms; not one unanswered or fruitlessly written. Was not that good and pretty of *la belle Rothschild?*

—A newspaper writer thus describes the ideal girl:—I saw a girl come into a street-car the other day, though, who had, I was ready to bet, made her own dress, and how nice she did look. She was one of those clean, trim girls you see now and then. She was about 18 years old, and, to begin with, looked well-fed, healthy, and strong. She looked as though she had a sensible mother at home. Her face, and neck, and ears, and her hair were clean—absolutely clean. How seldom you see that. There was no powder, no paint on the smooth, rounded cheek, or firm, dimpled chin; none on the moist red lips; none on the shell-tinted but not too small ears; none on the handsomely set neck—rather broad behind, perhaps, but running mighty prettily up into the tightly corded hair. And the hair! It was of a light chestnut-brown and glistened like specks of gold as the sun shone on it, and there was not a smear of oil or pomatum or cosmetic on it; there was not a spear astray about it, and not a pin to be seen in it. As the girl came in and took her seat she cast an easy, unembarrassed glance around the car from a well-opened gray eye, bright with the inimitable light of "good condition," such as you see in some handsome young athletes who are "in training." There were no tags and ends, fringes, and furbelows, or fluttering ribbons about her closely-fitting but easy suit of tweed, and as she drew off one glove to look in her purse for a small coin for fare, I noticed that the gloves were not new, but neither were they old; they were simply well-kept, like the owner and their owner's hand, which was a solid hand, with plenty of muscle between the tendons, and with strong but supple fingers. It would have looked equally pretty fashioning a pie in a home kitchen, or folding a bandage in an hospital. It was a hand that suggested at the same time womanliness and work, and I was sorry when it found a five-cent piece and had been re-gloved. One foot was thrust out a little upon the slats of the car floor—a foot in a good walking-boot that might have plashed through a rain-storm without fear of damp stockings—and an eminently sensible boot on a two and one-half foot, with a high instep, a small round heel, and a fairly broad tread. The girl was a picture, from head to foot, as she sat erect, disdaining the support of the back of the seat, but devoid of all appearance of stiffness. Perhaps the whole outfit to be seen, from hat to boots, did not cost $40; but I have seen plenty of outfits costing more than ten times or even twenty times that which did not look one-tenth or even one-twentieth as well. If our girls only knew the beauty of mere simplicity, cleanliness, and health, and their fascination!

THE
Young Scientist.

A Practical Journal for Amateurs.

(With which are incorporated "THE TECHNOLOGIST," "THE INDUSTRIAL MONTHLY," and "HOME ARTS.")

PUBLISHED MONTHLY AT $1.00 *PER YEAR.*

EDITORS.

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A Tempting Offer.

THE success which has attended our efforts during the past year, since the enlargement of the YOUNG SCIENTIST, has determined us to make it still better during 1884. We are now completing our arrangements for accomplishing this—making contracts with contributors, engravers, paper makers, printers, and others—and we are anxious to get our subscription list into shape as soon as possible. We have therefore determined to make the following tempting offer: To every one that sends to this office a subscription for 1884 at full rates, before the 10th of December next, we will send a copy of the "Workshop Companion." This is a book of 164 closely-printed pages, full of matter that is just what every one of our readers, boys and girls, wants. The price is 35 cents, strongly and neatly bound, so that those who accept our offer get the YOUNG SCIENTIST for almost half price.

If you want a copy of this work on these terms, send at once before you forget it.

It seems to be natural for every boy to possess a strong desire to stray from home and search in the outer world, as it were, for something different, and as they fancy better, than the surroundings they enjoy at home. This longing for change seems inherent in every boy of spirit, and is planted in him for a useful purpose, and is the very element that did the most towards peopling this continent. Boys, however, must submit to be guided by circumstances, and the wisdom of their friends, and under no consideration whatever, should a boy leave his home, for any length of time, without the consent of his parents or guardians. Indeed, boys should be well up in their teens before launching out on the wide world. There is no place like a peaceful home for opportunities of study and thought, and the bright and intelligent boy who spends his young days on the farm, or in the country village, stands a much better chance of success in after life, than the boy who is brought up under the shadow of a great city. The following fragment, taken from a recent address made in Middletown by General Ben. Butler, is opportune at this moment, and should be read carefully by every boy who is looking forward to the time when he will have chances to make his own opportunities in the great world outside the narrow limits of his old home:

"I have made my own way in the world. Why? Because as a boy I had time to reflect and think, and when I came to a city at the age of ten years, I have a right to say that I was as far advanced in my studies and in the knowledge of what I had studied as though I had been kept at work all the time at school. Who is the Speaker of your House of Representatives? Another man born, as I was, on a farm in New Hampshire. Who is the Mayor of Boston? He was born within six miles on a rockier farm than mine, if possible. I give you this advice of an old man who is passing away, and whatever may be its mistakes, it has no mistake in sincerity and earnestness. And, again, I say now as I began, that the wealth, the prosperity, the steadfastness, the hope of religion, of liberty and of freedom to the world, rests on the producing and on the country population of this Commonwealth and on that of the United States."

We have often spoken in these columns concerning the nauseous literature that falls into the hands of the average American lad, but it must not be supposed, that because we have not warned parents against the unwholesome reading that so plentifully finds its way into the hands of our girls, that we were not alive to the fact, that thousands of the future mothers of coming generations, are daily allowed to dawdle away their time, health and refinement, in poring over badly written soul-destroying novels.

It is very unusual to find a mother who is indifferent to her daughter's clothes. Practical-minded women will, even in spite of girlish remonstrance, insist on low heels, loose clothes, and warm wraps, and with wise saws and hygienic maxims crush the fashionable yearnings of budding womanhood for French heels, a genteel waist and sleeveless jackets.

But what can be said about the endeavor to provide for our daughters' mental nourishment and intellectual adornments?

There is no more amazing phase of nineteenth-century feminine development than its passionate and enervating indulgence in nauseous mental pabulum, and the appalling extent to which an unlimited supply of such stuff is furnished to the young. The same woman who is conscientiously careful of the school-companionship of her daughter of twelve or fourteen years is apparently criminally indifferent to the character of her associates in the world of books. She will watch what boy carries her girl's books home from school, but forgets to look below the cover of the new novel that same daughter has brought back from the circulating library, stopping there for it on the way home.

Now this apathy or ignorance in regard to what young girls read is responsible for the destruction of the finer tone of character of many of our children developing into womanhood, and explains a great deal of the frivolity, demoralizing coquetry and unfortunate 'affairs' which from time to time startle the community and bring sorrow and disgrace on highly respectable families.

No girl in her teens should be permitted to read a novel that has not first been read by some matured member of her family, or by some friend whose judgment is above reproach. If the book is such as may be trusted in the hands of a young girl, her friends will not hesitate to let her have it; if not, she will not desire to read it.

The resolutions lately passed by the New York Presbyterian Synod, in relation to the Roman Catholic Church, are both interesting and significant. The Synod congratulates the Roman Catholic province of New York upon the clerical supervision of its children, and the pains taken to guard them from the influence of pernicious literature.

This is right, and just, and only goes to prove the wisdom of the Roman Church, in preventing its children's minds from being poisoned at the most impressional age. Still it would have evidenced more wisdom on the part of the church if it had suggested—by name—the kind of literature of a secular sort, that, in the opinions of its fathers, would be the best for its children to read, for they will read, and if so, why not the YOUNG SCIENTIST?

It will be seen that we have introduced a "guessing department" this month, and one which we intend to continue from time to time in future issues. We should like very much if our younger readers would take "hold" strongly in this department, and send us matters for "guessing on," with the necessary answers. The "puzzles" will be given one month, and the answers thereto are expected to follow the succeeding month.

While it is not wise to make too many promises, yet it is sometimes necessary for the conductors of a journal like the YOUNG SCIENTIST, to give their readers an idea of what they may expect during the coming year; and, taking this view of the matter, it may not be out of place to say that in addition to the departments now in the journal, it is intended to add two or three others, including AQUATIC SPORTS, SCHOOL GAMES, the raising and manage-

ment of Pets, Poultry, and Bees, for all which we have secured assistance from specially competent contributors. These additions are to be made without trenching on the space now allotted to "Amateur Arts" and "Scientific Matters." Indeed, these departments will be improved in several particulars, and we can fairly promise that the volume for 1884 will outdo any of its predecessors in interest and usefulness.

Out of 780 young men under 21 years of age committed to the Eastern Pennsylvania Penitentiary during one year, 765 had no trades, though 772 were graduates of schools. This is a sad commentary on the too prevalent notion both of youths and parents that the only respectability and all the opportunities for individual advancement are in the kid-gloved pursuits. Young men roughly jostled out of the overcrowded professions and genteel employments find themselves utterly unfit for anything useful, and in too many cases turn to crime as likely to afford the most satisfactory returns. It is not the fault of education; it is the fault of the unfortunate social tendency of the times, which so seriously discriminates against legitimate labor, and falsely elevates white hands and good clothes and empty heads and pockets.

Another thing in connection with this matter, was the fact, that a majority of the 772 school graduates had been in their boyish days, readers of the villianous literature that is so prevalent and cheap, and not one of them had been provided with the YOUNG SCIENTIST or similar journals, by their parents. Had these boys been regular readers of "ours," they would not now have been living at the expense of the State of Pennsylvania. When will parents ever learn to provide their children with proper mental pabulum?

A number of leading ornithologists met in the American Museum of Natural History, New York, on September 26th, for the purpose of organizing a national association. Dr. Elliott Coues was elected chairman, and Mr. E. P. Bicknell secretary. The organization then adopted as its name The American Ornithological Union. A constitution which was adopted set forth the objects of the union, the principal objects being to further ornithological science and to revise the names and reclassify the list of North American birds. James A. Allen, of Cambridge, Mass., was elected President, Dr. Elliott Coues and Mr. R. Ridgeway vice-presidents, and Dr. C. Hart Merriam secretary. The society provided that there should be annual meetings. The number of active members was limited to fifty, and of foreign members to twenty-five, while no limit was fixed as to corresponding members.

The following gentlemen were elected to active membership:—C. Aldrich, Iowa; C. F. Bachelor, Massachusetts; C. E. Bendine, Oregon; E. P. Bicknell, New York; William Brewster, Massachusetts; M. Chamberlain, New Brunswick; C. B. Cory, Massachusetts; E. Coues, District of Columbia; D. G. Elliott, Long Island; A. K. Fisher, New York; J. B. Holden, New York; T. McIlwrath, Canada; C. H. Merriam, New York; E. A. Mearns, New York; D. W. Prentiss, Washington; R. Ridgeway, District of Columbia; R. W. Shufeldt, Louisiana; N. C. Brown, Maine; Professor S. F. Baird and J. A. Allen, Cambridge, Mass.

Athletic Notes.

Base-Ball.

THE DETROITS defeated the Eclipse Club, Oct. 8th, in Louisville, Ky., by 6 to 5.

THE PROVIDENCE CLUB missed a train and failed to appear, Oct. 6th, in Wheeling, W. Va., where they were booked to play the Toledo team.

THE HARVARD CLUB's receipts this season to Oct. 1st amounted to $4,609, and their expenses to $4,553. This leaves but a small balance on hand.

JOEL SAMSON, while engaged Oct. 5th in a game in the neighborhood of Elkhart, Ind., was hit in the temple by the ball, and died the same evening from its effects.

A GAME was played Oct. 6th, in Peoria, Ill., between the local professionals and the Allegheny. The visitors, who won by 12 to 7, were on their way home from

Omaha, Neb., where they had recently defeated the Union Pacific Club by scores of 6 to 2 and 10 to 7.

THE NEW CLUB of the Union League from Brooklyn will put a strong team in the field next season. They have already signed four players, and have several on trial. Their grounds will be located in the Eastern District, about twenty-five minutes' ride from Grand street or Broadway ferry.

METROPOLITAN *vs.* PROVIDENCE.—The first game this season between the above-named clubs was played Oct. 3d at the Polo Grounds in the presence of a large assemblage, and resulted in a well-earned victory for the Metropolitans, although they were weakened by the unavoidable absence of Holbert, Kennedy and O'Rourke. A wild throw by Esterbrook and a fumble by Roseman gave the visitors one run in the first inning. Radbourn, who was left after making a three-bagger in the first, got in a run in the fourth inning, when he was helped home by a passed ball and a wild pitch. The Mets earned two runs on two-baggers by Orr and Roseman, and singles by Keefe and Nelson, and obtained the winning run on errors by Erwin, Radbourn and Sweeny. Joe Start gave way to Sweeny in the third inning. The umpire seemingly favored the visitors, especially in calling balls and strikes. Keefe's effective pitching was the chief feature of the contest.

These two clubs contended again, with a similar result, on the Polo Grounds, Oct. 4th, when the attendance was small, owing to the cold weather. The visitors led off with five unearned runs in the first inning, although Lynch was batted but twice safely. Keefe then exchanged positions with Lynch, and, being better supported in the field, held the Providence down to one additional run, which was scored in the fourth inning on a two-bagger by Hines and a muff by Orr. The Mets made seven runs on four safe hits, together with bases on balls given Nelson, Brady and Crane, and four costly errors by Nava. The game was called on account of darkness in the seventh inning.

ATHLETIC *vs.* CLEVELAND.—The initial contest between the above-named clubs took place Oct. 4th, in Philadelphia, Pa., and proved to be an exciting struggle for superiority. Jones and Sawyer pitched for their respective clubs, the former proving the more effective. The Clevelands won by their superior fielding and timely hitting. Twice during the game the Athletics had three men on bases, and on both occasions they got runs in, but in each of these innings two men were left on bases, when one good hit would have decided the contest in their favor. It was too cold for sharp fielding. Evans and Bushong were injured early in the game, and gave way to Geer and McCormick. Blakiston played with the Athletics in the absence of Stovey.

ATHLETIC *vs.* PROVIDENCE.—The above-named clubs met for the first time this season Oct. 5th, in Philadelphia, Pa., the American Association champions then sustaining their most humiliating defeat of the season in the presence of about two thousand people. Radbourn retired the champions for no runs, and only three scattering safe hits, while seven of them struck out off him. Mathews was batted with ease by the visitors, Carroll leading with four safe hits, including two three-baggers. The visitors fielded sharply throughout. Two liners caught by Stovey, on one of which he made a double play, and a difficult running catch by Birchall were the redeeming features of the Athletics' play.

BALTIMORE *vs.* DETROIT.—The above-named clubs contended Oct. 4th in Baltimore, Md. Darkness obliged the umpire to call the game at the end of the eighth inning, when the score stood tied. Manning caught remarkably well and did the best batting of the game.

ATHLETIC *vs.* PHILADELPHIA.—The above-named clubs contended Oct. 3d on the grounds at Twenty-sixth and Jefferson streets, in Philadelphia, Pa., it being the seventh and deciding game of the series for the local championship. Between five and six thousand people were present, and the Athletics' share of the proceeds went to their players. During the first part of the game Stovey was presented with a silver-mounted rosewood bat and a silver base-ball, Stricker received a gold watch, and Bradley and Blakiston each came in for handsome badges. Bradley was too much for the Philadelphias, who made only one safe hit, while Purcell was batted freely by the Athletics. Stovey made his twentieth home-run of the season by a long hit over the left-field fence in the seventh inning. The Athletics won easily, outplaying their opponents at all points. The game was called on account of darkness at the close of the seventh inning.

These clubs met again at the same grounds, on Oct. 8th, when the Philadelphias secured their fourth victory of the series by a lucky streak of batting in one inning. The Athletics led up to the end of the fifth inning, having then scored four runs off five safe hits. The Philadelphias pounded Bradley in the sixth inning for six safe hits, including a three-bagger by Harbidge, and scored five earned runs. A single by Warner, a

two-bagger by Coleman, and a bad miss by Bradley, helped the Philadelphias to two more runs in the eighth inning. Stricker's second-base play was the fielding feature. Only one safe hit was made off Bradley in the first five innings, and off Coleman in the last six.

BOSTON *vs.* METROPOLITANS.—The fourth game of the series between the Boston and Metropolitan clubs—three of which were played last April—took place at the Polo Grounds, Oct. 6th, before a good crowd, though it was bad weather, rain falling during most of the game. Lynch was in the Metropolitan "box," and he troubled the visitors considerably. In fact, with as good support in all the positions as he had in most of them, the victory for the Bostons would have been doubtful. As it was, they did not earn a run off his pitching. The Mets found Whitney's pitching hard to hit, though Keefe and Nelson got an earned run from it by a three-base hit and a single, but no one else scored even a single hit. Crane's errors at second base were costly.

These clubs met again at the Polo Grounds on Oct. 8th, and, the weather being fine, there was a good attendance. The champions put in Buffinton to pitch, and he proved even more troublesome to the home batsmen than did Whitney, while the Bostons hit Keefe for an earned run this time. Gunning caught finely for the Bostons up to the eighth inning, when he injured a finger and had to give place to Hackett.

The last game the Boston champions played in this city was that of Oct. 9th at the Polo Grounds, when they sustained their first defeat at the hands of an American team, the Mets "Chicagoing" the visitors handsome by 1 to 0. A costly wild pitch gave the winning run to the home-team. The visitors got in only three hits off Lynch's pitching, and the Mets only four off Whitney's. Brady's outfield play was the feature of the Metropolitan fielding.

BOSTON *vs.* STATEN ISLAND.—The Boston team put in a first appearance in this vicinity since winning the championship Oct. 5th, when they played an exhibition game with the amateur nine of the Staten Island Club on the latter's ground. It was the fourth and last game of the series the Staten Island nine have played with the League teams. The Boston team included Gunning, who has been playing in the Northwestern League this season. He is originally from Fall River, and is evidently a good player. He caught Buffinton's difficult pitching very creditably indeed, putting out nine players, assisting four times, and having but one passed ball charged against him. Annis, late of the Anthracites, too, was in the team, Burdock not playing on account of a lame arm, while Hines was assigned to duty as umpire, which he attended to until struck in the face by a foul ball, when Burdock took his place. The Bostons had little difficulty in batting Tyng's pitching. Tyng was finely supported behind the bat by Laughran, who caught his pitching for the first time. The Islanders could do nothing with Buffinton's delivery, which was very effective. A very cool reception was accorded the champions by the small crowd of people present.

CINCINNATI *vs.* CHICAGO.—The above-named clubs—ex-champions of the American Association and League respectively—played a series of games last week in Cincinnati, O. The opening contest took place Oct. 1st, and resulted in a decisive victory for the Chicagos. Home-runs were made by Dalrymple and Gore, the latter, however, being decided out for failing to touch third base. The errors made by the Cincinnatis were very costly. Goldsmith was effective, holding the home-team down to five hits and striking out nine men. Errors by Pfeffer and Anson gave the Cincinnatis their only run. The attendance was good, although the weather was unfavorable.

ST. LOUIS *vs.* CHICAGO.—Fully four thousand people witnessed the first game this season between the Chicagos and St. Louis Clubs, which took place Oct. 5th in St. Louis, Mo. The visitors were aided very materially by close decisions in their favor.

The Chicagos defeated the St. Louis, Oct. 6th, by bunching their hits in the first and sixth innings. The winners made only four safe hits off Mullane, and thirteen of their men went out on strikes, while the St. Louis made ten hits off Goldsmith and only one struck out.

PHILADELPHIA *vs.* TRENTON.—The second game between the above-named clubs was played Oct. 5th in Trenton, N. J. The first game had terminated in favor of the Trenton team by a score of 15 to 14, and the present game was also closely contested. The home-team started off with the lead, and after losing it in the eighth inning got in the run that tied their opponents' score in the ninth. Darkness caused the umpire to call the game at the end of the tenth inning.

NEW YORK *vs.* CINCINNATI.—The above-named clubs played for the first time Oct. 6th, in Cincinnati, O., the games scheduled for the two preceding days having been postponed on account of rain. The visitors won with ease, a result mainly due to the excellent batting and base-running of Ward, who made three of the five runs credited to his club. The Cin-

cinnatis earned their only run on a two-baser by Mountjoy and a single by Carpenter. Troy's second-base play was the fielding feature.

CLEVELAND *vs.* QUICKSTEP.—The above-named clubs had a close and exciting contest together Oct. 3d in Wilmington, Del. The lead alternated until the ninth inning, when the Clevelands managed to secure the winning run.

ST. LOUIS *vs.* INDIANAPOLIS.—The St. Louis defeated the Indianapolis Club Oct. 2d in St. Louis, Mo., after an exciting contest of ten innings. The home-team took the lead in the first inning and held it up to the ninth, when the visitors managed to tie the score. Safe hits by Strief and Mullane allowed the St. Louis to make the winning run in the tenth inning.

ST. LOUIS *vs.* ALLEGHENY.—An exhibition game between the above-named clubs was played Oct. 7th in St. Louis, Mo. Davis, of Lynn, Mass., made his first appearance with the home-team and showed up well in the pitcher's position. Tom Mansell was credited with four safe hits off Bar, including a home-run. At the close of the game there was a foot-race of one hundred yards between Walter Latham and Mike Mansell, to decide the long-mooted question of superiority in running. Latham won easily.

ST. LOUIS *vs.* NEW YORK.—The New Yorks visited St. Louis, Mo., Oct. 8th, when they were defeated by the home-team's superior batting. Welch commenced pitching, but was knocked out of his position, and gave way to Ward. Latham's batting was the chief feature.

TOLEDO *vs.* CINCINNATI.—The Toledo team—champions of the Northwestern League—made their first appearance in Cincinnati, O., Oct. 7th, when they defeated the local club after an exciting struggle. The visitors did the best batting, Walker—their clever colored catcher—leading in that respect. A brilliant triple-play, accomplished by Welch, Barkley and Andrews in the fourth inning, was the feature of the contest.

Odd Notes.

—At the Tennis tournament held at Camp Washington, Staten Island, Oct. 3d, 4th, and 5th, by the Ladies' Club for Out-door Sports, the prize for the ladies' singles was won by Miss Goodwin of the Franklin (N. J.) Archery Club, defeating Miss Robinson, New Brighton Club, by 6-2 and 6-5, the latter securing one game by 6-4. The ladies and gentlemen's doubles were won by Miss Goodwin and Mr. Greenough, defeating Miss Ward and Mr. Shippen by 6-2 and 6-3.

—The senior tennis tournament at Yale College resulted as follows: Jenks first, Doolittle and Sheton second. In the freshmen tournament Haven was first and Thomas second.

—The Harvard Tennis Association on Oct. 2d held an election, resulting as follows: President, G. R. Agassiz, '84; vice-president, H. A. Taylor, '86; secretary and treasurer, G. W. Hoyt, '85; stewards, A. Curtis, '84; Pierson, '85; Minot, '86; and Kuh, '87.

—A novel race between a pigeon and a pony has just taken place at Bedworth, Eng., the former flying a mile and the latter galloping half a mile. A capital start was made, the starter standing half-way between the pigeon and the pony, and after a most exciting race the bird won by eighty yards.

—Says *The Sportsman* of London, Eng.: "Alfred Nixon, champion of the London Tricycle Club, who last year made the first and at present only tricycle journey from John o' Groat's to the Land's End, a distance of 1,007 miles in a fortnight, has just accomplished a ride of 750 miles, also for the first time on a tricycle, in 8 days 23 hours. Nixon left the Bank of England, London, on Wednesday, Sept. 12th, at twelve o'clock, and reached John o' Groat's House, Caithnesshire, Scotland, on Friday, 21st, at 11 A.M."

—The Somerville High-school eleven gave the Tufts College eleven an unexpected drubbing in a game of football on the college grounds at Medford, Mass., on Saturday, Oct. 6th. The Somerville boys were small and light, and therefore the collegians thought little of them, but were defeated by two goals and three touchdowns to one safety touchdown for Tufts.

—The Northside A. C. at a meeting held Oct. 4th elected the following officers: President, Thos. Moran; vice-president, Chas. Hamilton; treasurer, Harry B. Woods; secretary, Harry Kirby; captain, Wm. H. Fales; first lieutenant, Thos. Smith Sr.; second lieutenant, John F. Kirby.

—A match at football was played at New Haven, Ct., Oct. 6th, between the Yale College and Stevens' Institute football teams. The former won by a score of six goals and seven touchdowns to three safety touchdowns.

—The leading football clubs of Montreal, Canada, kicked leather for the possession of the champion cup on Sept. 29th. The weather was pleasant though cool, the gathering of spectators large, and the grounds were in capital order. The contest was a splendid one, both teams doing fine work, the play of the

Lousons, the Campbells, Fisher, Henneker and Hamilton being particularly noticeable on the side of the Montrealers, while for the Britannias McLeod, Myles, Blaiklock, Patterson and McLennan deserve special mention. The first game was won for the Britannias by Blaiklock, while Hamilton secured the two following games for the Montreals, who thus maintained their claim to the champion trophy, which they took from the Britannias in May last, after having lost it to them on Nov. 5th, 1881. The teams were as follow: Montreal—R. T. Henneker, E. H. Hamilton, E. W. Wand, A. Parry, A. E. Abbott, R. Stirling, S. P. Buchanan, J. N. Fulton, G. W. Cains, F. W. Cains, R. Campbell, A. J. Campbell, W. S. Louson, J. Louson, S. Fisher. Britannia—J. G. Ross, R. Kinghorn, S. M. Blaiklock, K. Young, J. W. McLennan, S. Campbell, J. J. Arnton, J. W. Cook, W. A. Munn, F. Scott, A. Woods, P. Myles, J. G. Writchener, J. Patterson, D. McLeod. Robert Esdaile was umpire for the Montreals, and R. D. McGibbon for the Britannias, while the position of referee was intelligently filled by R. W. Boodle.

Our Book Table.

Workshop Receipts, for the Use of Manufacturers, Mechanics, and Scientific Amateurs. Second Series. By Robert Haldane. London and New York: E. & F. N. Spon.

The first series of this work was devoted largely to such subjects as wood working and polishing, metallurgy, the working of different materials, and other matters of that kind. The volume before us treats more immediately of subjects which are specially related to chemistry, and although some of the topics that were discussed in the first series also appear in the present work, yet from the fact that they are handled in a much more complete and thorough manner, and embody the most recent information, the book may be regarded as entirely new.

The principal subjects which occupy a place in this volume are: Bleaching, Boiler Incrustations, Cements and Lutes, Cleansing, Confectionery, Disinfectants, Dyeing, Essences, Extracts, Fireproofing, Glue, Glycerine, Ink, Leather, Matches, Pigments, together with about twice as many more, which we have not room to cite.

All the articles show, on careful examination, that the author has brought his work down to the date of going to press—giving the best and most recent information in each case. Judging by those articles with which we are specially familiar, we find that the author has not contented himself with mere "scissors" work, but has carefully revised the receipts and processes given. The book is certainly one of great value.

Old Italian Embroidery. By Franz Lipperheide, 38 W. Potsdam Street, Berlin, Germany. Published in 2 volumes.

The volumes contain some fifty-six plates of fac-simile designs of old work. The plates themselves are works of art, being fine and clear engravings of high merit. Besides the plates, which contain several hundred embroidery designs, the work is finely illustrated, with engravings, showing the method of forming the "stitch" for the performance of the work exhibited, which is on a new plan invented by the author, and which shows the work finished alike on both sides of the material.

The explanations and instructions are written in German, and to those who are conversant with that language, the text will prove simple and easy to understand. The designs are copied from work executed during the 14th, 15th and 16th centuries, examples of which are preserved in the European museums. A large number of the designs were obtained from the Berlin Museum through the kindness of the director, Dr. Julius Lessing.

Full particulars of the work may be obtained by addressing the editor, as above.

American Newspaper Annual. Philadelphia: N. W. Ayer & Son.

This is a portly octavo volume, containing a list of *all* the newspapers and other periodicals issued in the United States and Canada. It gives the year when each journal was established, its size, circulation and general characteristics. In addition to this, it gives the population and other facts in regard to the towns and cities where the different journals are published, so that it forms an exceedingly useful gazetteer. The work seems to have been prepared with great care and accuracy, and must prove of great value to publishers, advertisers, and students who desire to know just what journals are published in their own departments. The advantages which it presents in the latter direction should insure the presence of one copy in every public library.

Astronomy for Amateurs.—November.

BY BERLIN H. WRIGHT.

THE PLANETS.—NOVEMBER, 1883.

(All Computations are for the Latitude and Meridian of New York City.)

Venus.—But few glimpses of Venus will be had this month, as she sets only about one-half hour after the Sun, as follows:

November	10th—5	22	evening.
"	20th—5	25	"
"	30th—5	35	"

She is moving eastward at the rate of about one degree a day, and at the close of the month will be upon the western margin of the Galaxy

close to the Milk-Maid's Dipper. She crosses the earth's path on the 8th, after which time she will be south of the Ecliptic. A telescope will show her with flattened sides or a gibbous phase.

Mars reaches his western quadrature Nov. 1st, and becomes an evening star upon that date, and will attract much attention from his situation, being almost within the Sickle in Leo. Regulus, at the end of the handle of the Sickle being a few degrees east of him. He rises as follows:

November 10th—10 35 evening.
" 20th—10 12 "
" 30th— 9 47 "

Jupiter is bowling along slowly after Mars, the distance between them gradually increasing. Jupiter rises as follows:

November 10th—9 55 evening.
" 20th—9 17 "
" 30th—8 37 "

The Moon passes 5° south of him on the 19th, and on the 21st he is stationary near the cluster Præsepe in Cancer. The following are the principal events transpiring with his satellites in the earlier part of the nights of November:

Nov. 6th—11 26 eve.,	Occultation.—	Reap.	(I.)
" 8th—11 8 eve.,	Eclipse.	"	(III.)
" 15th—11 47 eve.,	"	Dis.	(III.
" 21st—10 3 eve.,	Transit.	Ing.	(I.)
" 21st—11 13 eve.,	" (shad.)	Eg.	(I.)
" 22d— 0 23 mor.,	"	Eg.	(I.)
" 22d—11 25 eve.,	"	Ing.	(II.)
" 26th—10 8 eve.,	"	"	(III.)
" 29th—11 22 eve.,	Occultation,	Reap.	(I.)

Saturn will be brightest Nov. 28th, being at that time in opposition to the Sun, rising at sunset, and passing the meridian at midnight. He will be in conjunction with Aldebaran on the 2d, being $3\frac{1}{2}$° north of the star, and on the 15th in conjunction with the Moon, being only 1° north of that luminary. He passes the meridian as follows:

November 10th— 1 11 morning.
" 20th— 0 28 "
" 30th—11 41 evening.

Neptune also reaches his opposition this month on the 12th, passing the meridian on the 30th at 10.30 P.M.

NOVEMBER METEORS.

The two great meteoric epochs of November are Nov. 11th-15th, and Nov. 24th-Dec. 7th, the former called the Leonids and radiating from the Sickle in Leo. The maximum of this group is reached on the 13th. The last great display of these was in 1866. The Andromedes II. is the other great meteoric group encountered by the earth in November, radiating from near Almaach, the 2d mag. star in the left foot of Andromeda; the maximum is reached on the 27th, and the last great display was in 1872. Other minor groups prevail as follows: The Leonimoroids, from the compact cluster of stars in Leo Minor—Nov. 25th-28th; also on same date a swift group describing short arcs from near the star in the end of the handle of the Great Dipper in Ursa Major. The Geminids are met with Nov. 27th, radiating from near Castor; a very rich group, continuing during most of December, reaching its maximum Dec. 10th-11th.

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS, NOV. 21ST, 1883.

	H.	*M.*	
Alpha Andromeda (Alpheratz) in meridian	8	4	eve.
Omicron Ceti (Mira) variable, in meridian	10	15	"
Beta Persei (Algol) variable, in meridian	11	2	"
Eta Tauri ("Seven Stars" or Pleiades) in meridian	11	42	"
Alpha Tauri (Aldebaran) in merid.	0	34	mor.
Alpha Aurigæ (Capella) in merid.	1	13	"
Beta Orionis (Rigel) in merid.	1	14	"
Alpha Orionis (Betelguese) in merid.	1	54	"
Alpha Canis Majoris (Sirius or Dog Star) rises	9	41	eve.
Alpha Canis Minoris (Procyon) rises	9	16	"
Alpha Leonis (Regulus) rises	11	19	"
Alpha Virginis (Spica) rises	4	0	mor.
Alpha Bootis (Arcturus) rises	3	3	"
Alpha Scorpionis (Antares) invisible.			
Alpha Lyrae (Vega) sets	11	28	eve.
Alpha Aquillae (Altair) sets	10	16	"
Alpha Cygni (Deneb) "	2	37	mor.
Alpha Pisces Australis (Fomalhaut) sets	10	52	eve.

De Land, Florida.

Origin of Postage Stamps.

It is generally believed that postage stamps are of quite modern origin. This is an error, for we find from the current number of the Bulletin de l'Imprimerie et de la Librarie that the first collector of postage stamps lived in the reign of Louis XIV. During the seventeenth century, when the King changed the place of residence for the court, persons in his suite procured tickets which they stuck on letters intended for Paris, in order that they might be received and forwarded by his majesty's carriers. M. Fenillet de Conches, a collector, possesses a letter directed to Paris foi Mlle. de Scudery by Pelisson Fontamer, on which is found a kind of postage stamp. In 1654 a regulation was issued to the effect that

persons writing from one part of Paris to the other might have their letters, etc., faithfully carried and diligently delivered to any address, provided they attached to their letters a ticket indicating that its carriage was paid, as money would not be directly accepted. This ticket might be attached to or placed around the letter, or affixed in any convenient manner so that it be plainly visible. The price of this pre-paid ticket was a sou. The system had been in force since August, 1633.

A Large Object-Glass.

The object glass for the great refracting telescope intended for the Russian observatory of Pulkowa, has been finished by the Messrs. Clark, of Cambridge, Mass., and is the largest glass thus far constructed. The order for the glass was given in 1881 by Prof. Struve, the director of the observatory, who has lately visited this country for the purpose of subjecting the glass to certain tests of its quality. These, it is said, proved to be in every way satisfactory, and the object glass is by this time on its way to its ultimate destination, if, indeed, it has not already arrived there. This great object glass is thirty inches in diameter. Pulkowa, however, will not be able to claim very long the distinction of having the largest refracting telescope in the world, for the great Lick telescope for California will have an object glass of thirty-six inches diameter, or six inches greater. Six inches appears a small addition, but it represents an enormous increase in power, for the light-gathering area of the Lick object-glass will be to that of Pulkowa as 1,296 to 900, or forty per cent. greater. The rough disk of the flint portion of the Lick glass has already been received by the Clarks, and they are at work upon it. It will be several years before it is finished.

Advances in Scientific Discovery.

The opinion is commonly expressed by those who are not well informed, that the world is so rapidly advancing in scientific discovery that a few years more of such extraordinary advancement as we have witnessed during the past quarter of a century, will practically exhaust the sources of discovery, and the scientist will sigh in vain for "for new worlds to conquer." No opinion could, in reality, be more delusive than this. Each fresh discovery which discloses a secret that nature has so long and carefully guarded, illuminates with its feeble rays a background of other mysteries still unsolved, and so far from narrowing the field of discovery, widens the circle of the unknown and places its horizon still further off. He who thinks he has mastered a science is a superficial thinker. The profound thinker is he, who, having possessed himself of all the knowledge of his predecessors, perceives how little the sum of that knowledge is, in comparison with what still remains to be learned.

Scientific News.

—There is a curious clock in Japan. This clock, in a frame three feet high and five long, represented a noon landscape of great lovliness. In the foreground were plum and cherry trees and rich plants in full bloom; in the rear, a hill gradual in ascent, from which flowed a cascade admirably imitated in crystal. From this a thread-like stream glided along, encircling in its winding rocks and tiny islands, but presently losing itself in a far-off stretch of woodland. In the sky turned a golden sun, indicating as it passed the striking hours, which were all marked on the scale below, where a slowly creeping tortoise served as a hand. A bird of exquisite plumage, resting by its wings, proclaimed the expiration of each hour. When the song ceased a mouse sprang from a grotto near by, and, running over the hill, hastily disappeared.

—"C. S.," says an *Exchange*, "asks the origin of the belief or superstition that it was fortunate for any one to find a horse-shoe and that nailing it over one's door or hanging it in the house would bring good luck. The English antiquary, John Aubrey, who wrote about the middle of the seventeenth century, says that in his time most of the houses in the West End of London were protected against witches and evil spirits by having horse-shoes fastened to them in various ways. It was the belief that then no witch or evil genius could cross the threshold which was protected by the shoe. The fact is that the superstition has been traced so far back, and then we lose it in the obscurity of the ages. The custom of nailing horse-shoes for luck to all kinds of sailing craft is still in vogue, and is religiously maintained to be a wise and lucky measure. The superstition goes further, by making it fortunate for any one to find a horse-shoe, and the good luck is increased with the number of nails that are attached to the shoe when it is picked up."

—Cros. Vergeraud has utilized the properties of bichromates to produce positives directly on paper. He first saturates a suitable kind of paper with a solution of 2 parts of bichromate of ammonia and 15 of glucose in 100 parts of water, dries it, and exposes it under any positive (either a glass transparency, a drawing, tracing or other flat object). As soon as the exposed parts turn gray, it is immersed in a bath consisting of one part of nitrate of silver and 10 of acetic acid in 100 parts of water. The picture makes its appearance at once, and is of a blood-red color (bichromate of silver). Wherever the light acts upon it, the glucose reduces the bichromate, but in those places which have been protected by the

drawing, etc., the bichromate will be unchanged, and hence capable of forming chromate of silver, which is insoluble in water, If dried by the fire, the picture will remain red; but if exposed to the sunlight, it becomes dark brown. Sulphuretted hydrogen, or a bath of potash and copper turns it black.—*Comptes Rendus.*

Practical Hints.

—A soft alloy, which attaches itself so firmly to the surface of metals, glass, and porcelain that it can be employed to solder articles that will not bear a very high temperature can, it is said, be made as follows: Copper dust obtained by precipitation from a solution of the sulphate by means of zinc is put in a cast-iron or porcelain-lined mortar and mixed with strong sulphuric acid, specific gravity 1.85. From 20 to 30 or 36 parts of the copper are taken, according to the hardness desired. To the cake formed of acid and copper there are added, under constant stirring, 70 parts of mercury. When well mixed the amalgam is carefully rinsed with warm water to remove all the acid, and then set aside to cool. In 10 or 12 hours it is hard enough to scratch tin. If it is to be used now, it must be heated so hot that when worked over and brayed in an iron mortar it becomes as soft as wax. In this ductile form it can be spread out on any surface, to which it adheres with great tenacity, when it gets cold and hard.

—A man can always learn something if he will only look about him. I was at the Postoffice Department the other day, says an observer, and I noticed an employee busy affixing stamps to envelopes. Every time he moistened the right hand corner of the envelope and then placed the stamp upon it. I asked him if there was any advantage in wetting the envelope instead of the stamp, and he said: "You notice that I moisten the envelope first; well I do that because it is the right way. There is a right and a wrong way to everything, and consequently there is a right and a wrong way to put on postage stamps. It is impossible to moisten a stamp with the tongue unless a small proportion of the gum adheres to it. Now this gum is by no means injurious, but then the department does not advertise it as a health food; so the only way left is the right way, and that is to moisten the envelope first." After listening to this brief statement I felt as though I had emerged from the deep shade of ignorance to the glorious sunlight of knowledge.

—Men, women and children require just so much sleep, and if they do not have it, suffer in consequence. I do not think a person should be waked in the morning, and for this reason, when a man falls asleep, he is in the shop for repairs, as the railroad men say. His frame and all its intricate machinery is being overhauled and made ready for the next day's work. The wear of the previous day is being repaired. Nature is doing that herself. She knows what the tired frame needs just as she knows how to make the heart throb and send the blood coursing through the veins. Then she takes that tired frame, lays it down on a bed, surrounds it with the refreshing air of night, covers it with the soft darkness, and lets the man rest. "Tired nature's sweet restorer, balmy sleep," visits him, and as the hours wear by, his energies are renewed, his strength comes back, and finally, when morning breaks and the sunlight steals through the lattice, he opens his eyes and is himself again. Or, if he is early to bed, he awakes with the cock's crowing. Now, who shall go to that man's side an hour before he opens his eyes, and say to nature, stand aside and let him get up; he has had enough of rest? Well, nature will say: "You can take him if you will, but I will charge him with an hour's loss of sleep, and I'll collect it out of his bones and nerves, and his hair and eyesight. You can't cheat me. I'll find property to levy on!"—*Journal of Health.*

Notes and Queries.

In continuing this department, which has been found of so much value, we would remind our readers who wish for information on any of the arts and sciences, that they are cordially invited to make their wants known through this column, and those of them who can furnish accurate answers to questions asked are requested to send in replies. Doubtless many of our subscribers may know of methods, processes, or devices that may be better or more suitable for the particular case in question than anything generally known, and it is this reason that induces us to keep this department open for a medium, where an interchange of ideas and practices may be made to the advantage of all our readers. Correspondents will please send their full address when forwarding their communications—either questions or answers—not for publication, unless expressly so stated, but so that we may know where to find the writer if desirable. Communications should be sent in on or before the first of each month previous to publication, to insure insertion in next issue.

Answers.

133. NEW HAMPSHIRE BOY.—Concrete is the best building material in the world. It is four times cheaper than wood, six times cheaper than stone, and superior to either. Proportions for mixing: to eight barrows of slaked lime, well deluged with water, add 15 barrows of sand; mix these to a creamy consistency, then add 60 barrows of coarse gravel, which must be worked well and completely; you can then throw stones into this mixture, of any shape or size, up to ten inches in diameter. Form moulds for the walls of the house by fixing boards horizontally against upright standards, which must be immovably braced, so that they will not yield to the immense pressure outwards as the material settles: set the standards in pairs around the building, where the walls are to stand, from six to eight feet apart, and so wide that the inner space shall form the thickness of the wall. Into the moulds thus formed throw in the concrete material as fast as you choose, and the more promiscuously the better. In a short time the gravel will get as hard as the solid rock.—RUBY.

134. WEATHERWISE.—There is no valid reason why you should not be able to construct a tolerably correct barometer if you follow the directions given herewith: Get a strong glass tube 34 inches long and of a smooth even bore. Close one end by means of a spirit lamp and blow

pipe, or Bunsen burner, and fill the tube with pure, clean, dry mercury, excluding all bubbles of air. Now place your finger over the open end of the tube, and cautiously insert it in a small cistern or vessel partially filled with mercury. Do not remove your finger until the end of the tube which it covers is safely below the surface of the mercury in the vessel. When the tube is thus inserted, remove your finger, and the contents will fall until the height of the mercury is nearly 30 ins. above the level of the mercury in the cistern beneath. In the barometer the mercury never rises above 31 inches, and seldom falls below 27. The tube may be fitted into a grooved wooden case, the scale attached in the proper place, and the final adjustment made by comparison with a correct instrument.—KINO.

135. F. K.—A beginner need not worry himself about the points of a violin. Learn to play first, and then, when you understand what you are about, go in for an "old master" if you please; but most of the merits of such instruments are imaginary, and the copies are just as good. In fact, nine-tenths of the Amatis, Stradivaris, Guarneris, and Bergonzis have been made in Paris, cooked in Brussels, and labelled in Lambeth, to be "picked up as bargains" in New York, Boston, or Philadelphia.—MUSIC.

136. PUZZLED.—To bore a hole through a glass plate, make your drill white-hot, and then plunge it into mercury. Use camphor dissolved in spirits of turpentine to lubricate with, and you will get through the glass as easily as through a piece of mahogany. There are several other ways to drill holes in glass, just as simple. See "Workshop Companion," price 35 cents.—OLD READER.

137. DAISY.—We cannot prescribe for your pet dog as we do not know its ailment. In asking us to prescribe a method of treatment for any pet animal, whether bird or beast, our readers would do well to mention how it has been fed. Feed your canary only on canary seed and rape, two parts of the former to one of the latter. Give three drops of castor-oil every week; put a rusty nail in the water for a fortnight, and annoint the naked parts once a day with pure salad-oil.

138. DAISY.—1. For dandruff get a pomade as follows:—Nitric oxide of mercury ointment, one part; ordinary pomade, four parts; rub in night and morning, not on the hair, but into the scalp; wash twice a week with carbolic soap; take a little sulphur internally three times a week, and, if the health be low, a course of iron and quinine. 2. Grease spots may be taken out by placing pieces of brown paper over them, and pressing with a hot iron as long as the bits of paper will absorb the grease. 3. Depends entirely on the kind of ink and color of cloth. Spirits of salt will remove some.

139. CYCLIST.—1. The earliest notice of velocipedes is said to be that by Blanchard on July 17, 1779. The first bicycle ever made and run successfully was invented and built by a Scotchman, Gavin Dalzell, of Desmahagow, in 1836. The indiarubber tyres were the invention of Mr. E. A. Cowper. 2. Plated machines are almost as difficult to keep properly clean as bright ones. 3. Keep a pin down the nozzle of your oil-can, and the aperture will always keep clear; but do not use oil, try glycerine instead.—BICYCLE.

140. FARMER BOY.—A horse will travel 400 yds. in 4½ minutes at a *walk*, 400 yds. in 2 minutes at a *trot*, and 400 yds. in 1 minute at a *gallop*. The usual work of a horse is taken at 22,500 lbs. raised 1 foot per minute, for 8 hours per day. A horse will *carry* 250 lbs. 25 miles per day of 8 hours. An average draught-horse will draw 1,600 lbs. 23 miles per day on a level road, weight of wagon included. The average weight of a horse is 1,000 lbs.; his strength is equal to that of 5 men. In a *horse mill* moving at 3 feet per second, track 25 feet diameter, he exerts with the machine the power of 4½ horses. The greatest amount a horse can pull in a horizontal line is 900 lbs.; but he can only do this momentarily, in continued exertion, probably half of this is the limit. He attains his growth in 5 years, will live 25; average, 16 years. A horse will live 25 days on water without solid food, 17 days without eating or drinking, but only 5 days on solid food without drinking.—JOCKEY.

141. LITTLE MAIDEN.—"The onyx stone, on which the most valuable cameos are cut, is found in such plenty on the Uruguay River in Brazil that ships often take it for ballast," said a cameo cutter. "Some of it has been found in Germany, where much of the cutting is done. The market is flooded with cheap and imperfect cameos, the work of apprentices, yet there is a fair demand for new work at good prices, especially for portraits. The art of cameo cutting is very old, and some of the specimens of Roman work done 2,000 years ago are exquisite in tracery and design. They are produced by an extraordinary amount of labor, unaided by the modern improvements in tools. Such work was then done for monarchs or very wealthy persons, and a cutting requiring a year was a very common thing. The same quality of work is now within the reach of persons of moderate means. Three fair looking cameo cuttings, suitable for mounting as breast pin and earrings may be bought for $8. But cameo portraits cost from $50 to $250, according to size, and the stone for the latter would be worth about $70.

"A raised cutting on any stone is called a cameo; when the device is sunk it is called an intaglio. The onyx is preferred for cameos above all stones, because it comes in layers of two colors. The combinations are black and white, black and cream, red and white, and dark brown, called the sardonyx. The advantage of a cameo portrait is that it will last forever. The stone is so hard that it can be cut only with diamond dust. The process of cutting consists of holding the stone up to revolving drills whose soft steel ends are covered with diamond dust. The utmost patience and caution, and delicate manipulation are required to grind off the upper layer of stone. A mistake is fatal to the work. No steel can be made hard enough to drill the onyx. Even chrome steel will not do it, and that is so hard that a drill made from it will cut through an ordinary file. No acid will affect the onyx, and it will stand the greatest heat of the furnace if the heat be applied gradually, so as to prevent cracking."—HISTORICUS.

142. Answer to Query No. 66, for May, 1883. How many times has the end of the world been predicted by men of more or less weight? Are there any such doleful predictions hanging over us now? If not too late to answer I offer this. It would be difficult to say just how many have predicted the "end of the world," but it is true that many have done so; some of them being sober, thoughtful men, and not to be condemned as fanatical, because others have been so wild in their prognostications, as to shoot very wide of the mark. Second, are there any such doleful predictions hanging over us now? Answer: Those who have any claim to be heard on the subject must give the Bible as their authority; therefore, the best way to state what *is* predicted will be What do the Scriptures teach? and from this we may judge whether what they foretell may properly be called "doleful." Take an instance. The subject is brought up in Matthew xxix., 3, where the disciples ask of Christ the direct question, What shall be the sign of the end of the world? and the mistake made by expounders is in the meaning they give to the word world. It is taken to mean the globe on which we dwell, hence all the *confusion*. Whereas its proper use is of the world at large; the course of this world, this dispensation, which is to have its end, or, as the actual meaning of the Greek is, "the end of the *age*." This world is never to end, and the Scriptures do not say so; but on the contrary de-

clare that it is to endure forever. Ecclesiastics i., 4, reads, "The earth abideth forever." Now, if *this age* is to end (even in a tragical way) to give place to a better, is that doleful? If sin is to be banished, and *earth* as well as man *redeemed*, is not such a consummation better than its destruction, and more desirable than its *present* condition? If Christ, in delivering the race of man from the power of his enemy, also buys the Home of man and gives it back to him as an eternal inheritance, is not that an issue worthy of the Lord of the whole Earth? That Redeemer who is to rule and reign over the earth which He has bought and owns as the "coming man," "the coming King?"—E. B., Rutherford, N. J.

Queries.

143. Gluing up Stuff.—I find a good deal of difficulty in gluing up joints. I can't make them stay together. Will some one give me a few hints regarding this kind of work.—Amateur.

144. Emblems.—Will some one who is posted inform me of what are the various emblems of "God and the Father," "The Holy Spirit," and the "Trinity," and greatly oblige—Episcopalian.

145. Guinea Pigs.—I would like a few hints as to the keeping and management of Guinea pigs, with a statement of what they should eat.—Kino.

146. Violin.—How many pieces are there in a violin, and where are they situated?—F. K., Danbury.

147. Dressed Skins.—Can squirrell skins be dressed at home sufficiently nice to be made into trimmings and muffs, or for lining for cloaks?—Katie B.

148. Broken Paintings.—I have two or three oil paintings on which I set a great value; on one of them the canvas has been broken a little. How can I repair it to make it look well.—Anxious.

149. Ebonizing Wood-Work.—Having made some nice wooden articles, after the designs and descriptions published in the Young Scientist, some time ago, I am anxious to have them ebonized nieely, and would be glad to have some information regarding the materials used for the purpose, and the mode of application.—Willing to Learn.

150. Impressions of Ferns.—I would like to take some impressions of ferns if any one will kindly inform me how the work is done.—Sadie.

151. Etching on Glass.—Any information on this subject will confer a favor on—Etching.

Market Report.

Retail Prices.

IMPORTED CAGE BIRDS.

Canaries, *Belgian*, per pair	$6.00 to 15.00
" *French*, per pair	6.00 to 15.00
" *German, Hartz Mts.*, each	2.50 to 10.00
Gold Finches, each	1.50
Gold Finch (mules), each	2.50 to 5.00
Bull Finches, not trained, each	2.50
Bull Finches, trained to sing two tunes, each	10.00 to 40.00
African Finches, per pair	2.50 to 5.00
Chaffinches, each	1.50
Talking Mino or Mina	10 00 to 25.00
Linnets, each	1.50 to 2.00
Linnets (mules), each	2.50 to 5.00
Green Linnets, each	1.50
Java Sparrows (blue), each	1.50
Java Sparrows (white), per pair	6.00 to 8.00
English Sparrows, per pair	1.00
Siskins, each	1.00
Gray Cardinal, each	4.00 to 5.00
Nightingales, each	8.00 to 25.00
Japanese Nightingales, each	5.00 to 10.00
Thrushes, each	5.00 to 7.00
Skylarks, each	5.00
Troopials, each	7.00 to 12.00
European blackbirds, each	5 00 to 7.00
Black-caps, each	4.00
Starlings, each	4.00 to 6.00

PARROTS.

Gray Parrot	10.00 to 15.00
Single Yellow-Head Parrot	8.00 to 12.00
Double Yellow-Head Parrot	10.00 to 15.00
West Indian "	4.00 to 5.00
Cockatoo (white)	18.00
Australian Shell Paraquets, per pair	6.00
"Love Birds," African Paraquets, per pair	6.00
West Indian Paraquets, per pair	3.00 to 5.00

All birds that are accomplished singers or talkers bring high and "fancy" prices. Parrots are rated by the number of words, sentences, and tunes they have learned.

AMERICAN CAGE BIRDS.

Canaries, each	2.50
Mocking Birds, females, each	1.00
" " singers	12.00 to 25.00
Robins	2.50 to 5.00
Blue Birds ("Blue Robins") each	1.50
Indigo Birds, each	1.00
Nonpariel, each	1.50 to 2.00
Virginia Cardinal, each	2.50 to 3.00
Bobolinks, each	1.50 to 2.00
Yellow Birds, each	1.50 to 2.00

Prices Paid by Dealers.

Roblns, per hundred	12.00
Biue Robins (Blue-Birds), per pair	0.35
Indigo Birds, each	0.50
Bobolinks, per dozen	3.00
Yellow-Birds, per hundred	12.00
Orioles, per hundred	25.00 to 35.00
Virginia Cardinals (Red-Birds), each	0.75 to 1.00
Nonpareils, each	0.75
Blue-Jays, each	0.35
Scarlet Tanagers, each	1.00
Red-Winged Starlings, or Black-Birds, each	0.25
Woodpeckers ("High-Holers"), each	1.00
Partridges, each	1.50
Cranes, each (according to variety)	10.00 to 20.00
Wood-Ducks, per pair	2.50
Wild Bronze Turkeys (one cock, two hens)	10.00 to 15.00

FANCY POULTRY.

Guinea or Pea-Hens	12.00
Pheasants, *English*, per pair	20.00
" *Golden*, "	35.00
" *Silver*, "	30.00
Pea-Cocks, per pair	20.00 to 75.00
Bronze Wild Turkeys	15.00 to 20.00
White Turkeys	10.00 to 15 00
Bantams, trio	3.00 to 10.00
Ring-Doves, per pair	1.50
Pigeons, *common*, per pair	0.75
" *all white, common*, per pair	1.00

BIRD FANCIERS' MATERIALS.

Breeding Cages (double)	1.50 to 4.00
Trap Cages	0.75
Wire " painted	0.50 to 4.00
Wood and Wire Cages	1.50 to 4.00
Prepared Bird Food, per quart	0.30
Bird Gravel, per quart	0.05
German Rape Seed, per quart	0.20
Canary Seed, per quart	0.20
McAllister's Mocking-Bird Food, 1lb. jar	0.35
" Canary-Bird Food, 1lb. box	0.20
" Mixed Bird Seed, 1lb. box	0.10
" Extra Silver Bird Gravel, qt. box	0.10
McAllister's Prepared Fish Food, per box	0.10
" Song Restorer, for birds, per bot.	0.25
McAllister's Bird-Lice Destroyer, in patent bellows box	0.25
McAllister's Bird Lime, per box	0.25
Cuttle-Fish Bone, each	0.05
Meal-Worms, per hundred	0.40
Nest Boxes, wire and tin,	0.10 to 0.15
Nest Material, per bunch	0.10

QUADRUPEDS.

Terriers, *black and tan*, each	5.00 to 30 00
Terriers, *Scotch and Skye*, each	5.00 to 30.00
Newfoundland Pups, each	10.00 to 15.00
Pomeranian or Spitz "	5.00 to 15.00
Greyhounds, *English*, "	10.00 to 25.00
Greyounds, *Italian*, "	10.00 to 30.00
Guinea-Pigs, *common*, per pair	1.50
" " " " large	1.50 to 3.00
Guinea-Pigs, *all white*, "	2.00
Squirrels, *gray*, "	5.00
Squirrels. *all white* "	15.00 to 25.00
Squirrels, *flying* "	3.00 to 4.00
Squirrels, *small red* "	2.00
Rabbits, *common*, per pair	1.00 to 2.50
Rabbits, *fancy breed*, according to age and purity of breed, per pair	3.00 to 15.00
Ferrets, *English*, "	15.00
Raccoons, each	4.00 to 5.00
Cats, *Maltese* (males), each	5.00
" " (females), each	3.00
Cats, *Albinos, pink or blue eyes*, each	3.00 to 5.00
Rats, *white China, pink eyes*, per pair	1.50
Rats, *piebald*, per pair	1.50
Mice, *white, pink eyes*, per pair	0.50
Mice, *piebald*, per pair	0.50

Prices Paid for Pet Stock by Dealers.

Guinea-Pigs, per pair	$0.40
Squirrels, *gray*, each	0.50
Squirrels, *flying*, per pair	0.75
White mice, per pair	0.15
Monkeys, according to variety	15.00 up.

MARINE AQUARIA STOCK.

Purple Bermuda Anemone	2.00
Fringed Sea Anemone, Medium-sized specimens	1.50
White-Armed Anemone	0.50
Small Orange "	0.10
Buccinum Snails, per dozen	0.25
Silver Shrimp, each	0.10
Small Hermit Crabs, each	0.15
Small Spider Crabs (decorating)	0.15
Very Small Edible or Blue Crabs	0.20
Barnacles, each	0.15
Nest-Building Stickle-Backs, three and nine-spined, per pair	0.30
Sheepshead Lebia fish	0.25
Killie-Fish	0 10
Eels	0.10
Sea-Horses, each	3.00
Pipe-Fish, "	0.25
Serpulæ, per mass	0.75
Small Edible Mussels, per mass	0.25
Sea Cucumbers	1.00
Sertularia, per mass	0.25
Tubularia, per mass	0.25

ALGÆ (SEA-WEEDS), FOR THE MARINE AQUARIA.

Ulva, per mass	0.25
Solaria, "	0.25

FRESH WATER AQUARIA STOCK.

Stickle Backs, Nest-building, per pair 0.30

Plants, per bunch	0.15	Small Turtles, each	0.25
Shells, per quart	0.50	Snails, per dozen	0.10
Small Dip-Nets	0.50	Frogs, each	0.15
Aquaria Cement 1lb. box	0.30	Fresh-Water Mussels	0.05

Valisneria Spiralis, per bunch	0.25	For the Microscope and Fresh Water Aquarium.
Nitella-Flexilis, "	0.25	
Anacharis, "	0.15	
Ball Plant (Utricularia)	0.15	

Small Rock Sun-Fish, Rock-Fish, Sun-Fish, Dace, Cat-Fish, Tadpoles, Eels, Lizards, each 0.05

Gold-Fish, medium size	0.15	These are all varieties of the golden carp or gold-fish.
" fountain size	0.25	
" very small	0.15	
" three-tailed	0.50	
Pearl-Fish	0.25	
Silver-Fish	0.05	
Japanese King-gio	2.00	

Prices Paid by Dealers.

Aquarium fish, per hundred	1.50
Gold Fish, per hundred	5.00 to 6.00
Aquarium Plants, per hundred bunches	2.00

BEAUTIFUL AND INTERESTING AQUATIC AND SEMI-AQUATIC PLANTS FOR ORNAMENTATION OF PONDS, LAKES, AQUARIA AND FOUNTAINS

White Water-Lily, per root	0.25
Yellow " "	0.25
Arrowhead Lily, 6 plants	0.25
Calla-Lilles	0.25
Pitcher-Plants, per root	0.25
Fresh-Water Cattails, per root	0.25
Giant Rush " "	0.25
Floating Heart (Limnantheum), per root	0.25
Calamus (sweet-flag), per root	0.25
Water-Cress, cuttings	0.25
Jack-in-the-Pulpit, 6 bulbs	0.25
Lobelia Cardinalis	0.25
Large, Showy Blue Lobelia	0.25
Water Violet (very curious)	0.25
Antipyretica Gigantia, interesting	0.25
" Fontinallis, interesting	0.25
The Water Net	0.25
Large Living Frogs	0.10

SHELLS.

Collections of small "cabinet" shells for schools, private cabinets, range from $5.00 to $50.00.

Mother-of-pearl shells, for painting, 75 cts. to $1.50.

Single specimen of cabinet shells range from 15 cts. each to $3.00.

Masses of corals, 25 cts. to $3.00.

Green snail and cowry, with the Lord's Prayer engraved on them, 50 cts. to $2.50 each.

Conch shells, for mantels or hearthstone ornaments: West India Conch, 25 cts.; East India Yellow Helmet, $1.00 to $2.50; Bahama Black Helmet, 50 cts. to $1.50; Bahama Hatchet Helmet, 50 cts. to $1.25. These shells are also for cameo engraving. Zanzibar Cameo, 25 cts. to $1.00.

Ground and polished shells: New Zealand Green Ear, 50 to 75 cts.; New Zealand White Ear, 50 to 75 cts.; Japan Black Ear, 50 cts. to $1.00; California Red Ear, 75 cts. to $1.25.

Fine shells for fancy work, according to colors and variety, per quart, $1.00 and up.

Fancy Wood for Scroll Sawing.

The prices given for the various woods used in this work are for the best of qualities of seasoned material, planed on both sides, ready for immediate use. They can be furnished in quantities to suit purchasers. Prices are by the square foot, and vary according to thickness of material.

DESCRIPTION		THICKNESS. 1-8	3-16	1-4
Black Walnut	Per Ft.	7	8	10
White Holly	"	10	12	14
Oak or Ash	"	8	10	12
Mahogany	"	10	12	14
Red Cedar	"	10	12	14
Rosewood	"	18	20	25
Satinwood	"	25	30	35
Birds'-Eye Maple	"	15	18	20
Tulip	"	30	40	50
Ebony	"	50	60	70
Cocobola	"	20	25	30
Amaranth	"	20	22	25

BEST IMPORTED SAW BLADES. 5 INCHES LONG.

Sizes to No. 6, per dozen	10c
" " " gross	$1.00
" No. 7 and 8, per dozen	15c
" " " " gross	1.25
" No. 8 and 10, " dozen	oc
" " " " gross	1.50

For all information on this subject, as to reliable dealers, etc., etc., send postal card to YOUNG SCIENTIST. When desired, the goods can be sent through this office, but in all cases remittances must accompany the order.

EXCHANGES.

Only those who are *yearly* subscribers, and whose names are entered on our books have the privilege of inserting exchanges.

Exchanges must be on separate slips of paper or postal cards. If mixed with business matter in letters or cards they are filed away and never reach the printer.

Exchanges must not exceed thirty words.

Buying and selling belong to the advertising department.

We reserve the right to omit the exchange column, when we have not room for it, and the amount of space at our disposal will regulate the number of insertions given to each *exchange*, the preference being always given to those who have not previously used our columns.

A number of first-class tricks, trick books, stamps, coins, Confederate money, curiosities, etc., to exchange for stamps or pet stock, such as rabbits, Guinea pigs, or squirrels. J. S. Reese, 52 Cedar St., Canton, Ohio.

Shell boat, Spanish cedar, 28 feet long, spoon oars; good order; been used but little; for offers. J. W. B., Carmel, N. Y.

Rowing machine, cost $10; photographic outfit, $16; Flobert rifle, $15; medical battery, $10; "Wood's Botany," etc.; for elk horns, deer horns, minerals, Indian relics, and all kinds of curiosities; would like list of curiosities from dealers. Chas. C. Collier, 3617 Locust St., Philadelphia, Pa.

Vol. III. of the *American Machinist* for the best offer of minerals. J. A. S., P. O. Box 83, East New York.

I have five or six complete years of the *Galaxy* (magazine) also a number of odd copies: I will exchange the lot for an induction coil in good condition, and giving at least a ¼ in. spark. W. B. Greenleaf, 480 La Salle Ave., Chicago, Ill.

I have eighteen numbers of the *Harper's Young People* (79 to 96 inclusive), containing part of the story "Tim and Tip," by James Otis, and all of the story "The Cruise of the Ghost," to exchange for a good spyglass, a good bull's-eye lantern, or a small telephone. J. H. Gamsey, Box 25, Wilmington, Will. Co., Ill.

A good violin, bow, box, books, all complete, worth $12.00, to exchange for Wood's Botany, Young Mechanic, or scientific books and papers; send list. A. D. Chamberlain, Trout Creek, Del. Co., N. Y.

A model self-inking printing press, chase 2½ x 3¼, 4 fonts card type, 3 type cases, ink, roller and furniture all in good order, to exchange for a good silver watch and nice chain. G. E. Wilmot, Box 88, Lebanon, N. H.

Any person wishing to exchange foreign stamps please send sheet and I will return it with mine. Box 90, Melrose, Mass.

New Nickels (without "cents") for offers; I also wish to exchange with curiosity, coin and stamp collectors residing in foreign countries. G. S. Griffin, Moline, R. I. Co., Ills.

1 Sea bean, 1 alligator's tooth, 1 small cocoanut, 1 liver bean, lot of other beans and shells and 50 foreign stamps for printing press and outfit, size of chase about 6¼ x 4 inches; send postal. Geo. O. Riphard, Westminister, Md.

W. C. Roseboom, Cherry Valley, N. Y., wishes to exchange with amateur photographers, or others; photographs and pictures taken by themselves, mounted or unmounted; give name of picture and camera.

I would like to exchange minerals, stamps and curiosities for the same. O. J. Lache, 1313 Poplar St., Philadelphia, Pa.

6 fonts type, 4 cases, 2 composing sticks, leads, rule, etc., outfit except press, to exchange for good tent, not less than 6x6, or offers; send card before exchanging. Wm. O. Brown, Middlebury, Vt.

I have double barrel muzzle-loading shot gun, watch, orguinette, harmonica, stuffed birds for Household microscope, photo. outfit, books on natural history; specimens or offers. E. O. Tuttle, Bristol, Vt.

A printing-press, chase 5½ by 7 inches, in good order; will exchange for a large self-inking press or type. A. W. Barrett, Canajoharie, N. Y.

A one-keyed flute and pair of No. 10 club skates for rifle; E-flat cornet, cost $25, for an eight or six-keyed flute of equal value; all good; or offers. J. L. Pilkington, Pearsalls, L. I.

For fossils or minerals; fine specimens of Pentremites—two varieties—from sub. carb. rocks; also Flobert rifle, in good condition, and McKinnon pen. M. H. Crump, Bowling Green, Ky.

I have for exchange a collection of about 80 species of fine fossils, all named and making a fine collection, which I wish to exchange for opera glass, microscope, telescope, or offers; correspondence solicited. A. Stapleton, Box 756, Seneca Falls, N. Y.

Wanted, amethyst, moss agates, trilobites, geodes, coral, and coal ferns in exchange for fifty Indian arrowheads, coquina rock and Florida moss. E. V. Sheerar, Wellsville, N. Y.

"Crystallography" (40c.); "Electricity" (40c.); "Selection and Use of Microscope," abridged, (30c.) Either in exchange for "Workshop Companion," or two for "The Microscope," by Ross, or offers. C. H. Denniston, Pulteney, N. Y.

Home Medical Battery, cost $7; Lemair's Field-Glass, No. 2202 of Queen's Catalogue, cost $15.50; Achromatic Spy-Glass, power 25 times. To exchange for books or offers. Emerson Heilman, Heilmandale, Pa.

A small collection of coleoptera, comprising 100 species and 300 specimens, all correctly named, in exchange for bird-skins, insects, books, or eggs. Emil Laurent, 621 Marshall St., Phila., Pa.

A small magic lantern, Ruby pattern, with twelve slides, for a good book on Entomology, with illustrations. Willie R. Hotchkiss, Morrisdale Mines, Clearfield Co., Pa.

Wanted, Thompson's "Witchery of Archery." Must be in good condition. Write before you send. J. Anthony, Jr., Coleta, Whiteside Co., Illinois.

A telescope worth $3.50, for a self-inking printing-press and outfit; chase not less than 2½ by 3½ in. Eddie Judd, 260 Connecticut St., Buffalo, N.Y.

To exchange for offers: $20 scroll-saw, Seneca Falls make, $4 Bailey circular plane, set of Auburn metallic planes, brass-bound four-foot rule, fourfold, Traut's patent combined plow, dado, etc., cost $7. F. A. Rappleye, P.O. Box 12, Farmer Village, Seneca Co., N.Y.

Bee Hive wanted; one of the old-fashioned straw "skeps"; say what you would like in exchange. Apis, care of Young Scientist, 294 Broadway, N Y.

A first-class type writer, in excellent condition, cost $125.00, to exchange for good microscope, telescope, or valuable scientific books; send full particulars. A. B. Box 114, Lewiston, Maine.

A $30 stencil outfit (Spencer's) for a self-inking printing press in good condition, chase about 6 x 9; rich ores and minerals of Idaho for scientific and instructive books, printing press, type, etc. J. P. Clough, Junction, Lemhi Co., Idaho.

Wanted pyrites of iron from Colorado gold mines in exchange for sea shells and other gems; send list of what you have to exchange. S. Ferguson, Eureka Springs, Arkansas.

A banjo in good condition, two pairs of rosewood bones, three splendid games, and a fine set of drawing instruments, for a good cornet, viola, violincello or double bass. L. B. Hill, Kalamazoo, Mich.

Scientific specimens of various kinds for same. Geo. E. Frazier, Caldwell, Ohio.

Lester W. Mann, Randolph, Mass., Box 162, has Demas scroll saw, lathe and tools, emery wheel; $20 worth patterns; Smithograph; large harmonica, cost $1.75; novelties in seeds; for large self-inking press or offers.

10 volumes Chambers' Encyclopædia, American Book Exchange edition (cloth); Bonanza printing press, chase 3 x 5, card type, ink roller; spyglass, power 10 times; for French triplet, 1-5 in., or offers. H. P. Nichols, P. O. Address, Bridgeport, Conn.

A good telescope, also foot-lathe and saw combined, each worth $10.00, for shells, fossils or relics. Independent, Conncautville, Crawford Co., Pa.

Birds' eggs to exchange for others; send list of what you have to exchange. Emil Laurent, 621 Marshall St., Philadelphia, Pa.

Twelve or fifteen volumes of the American Agriculturist to exchange for scientific books or offers. W. H. Osborne, Chardon, Ohio.

The Young Scientist

SCIENCE IS KNOWLEDGE.

KNOWLEDGE IS POWER.

A PRACTICAL JOURNAL OF

HOME ARTS.

VOL. VI. NEW YORK, DECEMBER, 1883. No. 12.

Overglaze Painting on Porcelain.—IV.

BY AURELIO DE VEGA.

MEDIUMS.—30. These are requisites, and upon the kind used and upon their quality depends, to an extent greater than is generally supposed, the appearance of the finished work. The mediums are, as their other general name of vehicles indicates, the carriers of the paint, the means by which it may be spread.

31. *Unsatisfactory Mediums.*—Several things have been tried from time to time as vehicles, in fact, pretty well everything that, having some substance of its own and being adapted to be smoothly spread, would hold the pigment in suspension. Thus we find among those not unfavorably mentioned occasionally, glycerine, syrup of the "golden" variety, and gum. The thinning agent for use with these is water. Now, glycerine is a very good thing in its place, as, for instance, when used in moderation for keeping water color moist, or for chapped hands, but it is certainly not in its proper place when on the china painter's palette. Water, when mixed with glycerine or syrup, evaporates very slowly, and the painting would be constantly liable to be smudged. Moreover, the saccharine uncrystallizable portion of the medium would be very likely to boil up in the muffle. Gum, when dry, will, under heat, pulverize and mix with the paint, producing an unsatisfactory appearance. I recommend, therefore, that all such mediums as these be avoided.

32. *Satisfactory Mediums.*—The mediums which are in general use and give every satisfaction, are of two kinds—a spirit and an oil; the latter being the vehicle proper, the former the thinning agent to render practicable the spreading of the mixed oil and paint in a coat of any desired depth or thickness. The spirit and the oil are both either of turpentine or of tar—spirit and oil of turpentine be-

ing used together, and spirit and oil of tar.

(*a.*) *Turpentine.*—Ordinary spirit of turpentine is, I think, too well known to require description. It is procurable at any oil store at about 25 cents a gill in small quantities, and is what house painters use in mixing their oil colors. This kind is not, however, always to be recommended for painting purposes, as frequently it contains impurities, and has more or less of a tone or tint about it. The right kind for painting is the rectified spirit to be procured at an artist's material shop, where the price will probably be ten cents for a little bottle holding about two ounces. This spirit is as clear as the proverbial crystal, and as limpid as the purest water, and when fresh, is colorless and does not present the slightest trace of oil or water. This kind, and this only, should be used in painting. At the same time the common turpentine, when quite clear, and clean, and white, answers very well, as has been noticed in Sec. 28, for washing the brushes and palette with, and for removing paint from the palette knife, etc. The oil of turpentine is also known as fat oil. It is viscid, much of the consistency of golden syrup, and has something of the color of clouded amber. This may be purchased for 25 cents a small bottle, but it may also be prepared from turpentine by the amateur, thus:—Into a saucer—the flatter the better—pour a little spirit of turpentine, say from a dessert to a small tablespoonful, according to the size and flatness of the saucer, and over the saucer place a layer of muslin, sufficiently close in texture to prevent dust getting to the turpentine, and yet not so close as to prevent evaporation. A very good plan is to place the saucer, mouth down, on the muslin, and cut the latter with a ¾-inch margin, then make a narrow hem in the muslin, into which may be run a piece of round elastic, this should then be drawn sufficiently tight to catch well over the edge of the saucer. The arrangement is shown in Fig. 21. The saucer with its turpentine should then be put in a place where evaporation will be free. It should not, however, be put over the fire or a stove so as to hasten the evaporation, or the heat might dissipate the whole. When the spirituous part of the liquid has passed off there will be found left the oil at the bottom of the saucer. Fresh spirit may be added, and the process repeated until there is enough oil to pour off.

(*b.*) *Tar.*—The spirit of tar is in two shades—one a rich amber, the other a dark brown, but both are alike in nature. The oil of tar corresponds to it in the same way as the oil of turpentine does to

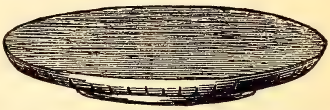

FIG. 2ˉ.—SAUCER FOR PREPARING OIL OF TURPENTINE.

the spirit of turpentine. The spirit and oil of tar are of similar use to the other spirit and oil, and are employed principally by those who object to the vapor of the turpentine as causing headache or affecting the throat.

The spirits of turpentine and of tar are extremely volatile, the former being somewhat more so than the latter; and during the working, sufficient may pass off to render the paint somewhat difficult to deal with. This difficulty is, however, only a slight one, and is easily overcome by the use of a little

(*c.*) *Oil of Lavender*, or oil of spike, as it is sometimes called. This is a perfectly volatile and fluid oil, but very much less volatile than either of the above-mentioned spirits, and a small quantity is added to the other mediums used when it is desired to keep the work *open*, that is—to counteract its drying or fattening through loss of spirit.

Caution.—Fat oil is not entirely free from one of the objections raised above, to the use of the mediums regarded as unsatisfactory, inasmuch as it too will boil up, or blister, or blib, or spit, if used in excess; but in this case the remedy is easy: 1, not to use too much; 2, if much must be used, it can, while fresh, be easily evaporated to dryness with the exhibition of moderate heat.

Boiling Up.—It may here be explained

that the result of boiling up, when there has been too much oil mixed with the paint, is that rough, jagged, or broken-blistery appearance, which is similar to that presented when a glaze has been subjected to a greater heat than it was made to bear, and which may often be seen on common goods. The boiling oil bubbles and raises a thin film of paint. The paint subsides to the edge of the bubble, and when the latter bursts there is left a rough-edged hole, with but little if any paint within its edge, but with too much round it.

33. *The Mediums should be kept* in bottles with closely-fitting stoppers, especially the spirits, as otherwise these would quickly become "fat" by evaporation. For general purposes, corks are preferable to glass stoppers. The plan I have found best is, on getting a new bottle of turpentine, immediately to decant the whole into small bottles. When a large bottle is only half full, the oxygen of the air in it attacks the turpentine with the formation of water and resin. The most useful are little drop bottles, like those in which homœopathic medicines are usually put up, and which are furnished with a little spout.

PAINTS.

34. *General Composition.*—The colors used in painting upon china or earthenware are, for the most part, oxides of certain metals. In only a few cases are the metals in a simple state used, those principally so employed being gold, silver, platinum, and copper; and these are so used only when the natural sheen of the metals is required, or in bronzes. The metal oxides having been rendered as nearly chemically pure as possible, are either singly or two or more in combination, and in the form of a powder, intimately mixed with triturated colorless glasses of varying composition, according to the nature of the oxide and the degree of hardness required in the pigment. The mixture, as ready for use, is an impalpable powder.* When this mixture of colored oxide and colorless glass is, with the aid of the mediums which have been described, properly applied to the glazed ware, and the painted ware gradually raised to a certain degree of heat in a specially constructed kiln called a muffle, the glaze of the ware, which we have seen to be a modification of glass, and the glass forming part of the mixture, both soften sufficiently to enable them to coalesce, and in this increased thickness of glaze, the coloring matter is, in the large majority of cases suspended, and in particles so fine as to be separately discernible only in thin films under the microscope. A few colors, however, such as the deep transparent blues, and yellows from one source, are really, to a certain extent, stained glasses, the glass having more or less completely dissolved the coloring matter. China or enamel colors then, from their containing, as an essential constituent, a glass or flux of vitrifiable composition, are called *vitrifiable pigments.*

*On the more particular composition of china colors, as affecting their tints in combination, I shall have to speak in a future paper, when treating of colors arising from mixture.

35. *Home Manufacture of Colors.*—In this connection I may notice a question which has not unfrequently been put to me, viz., whether an amateur cannot make his own pigments. The answer is that in general it is quite possible for him to do so, but whether it would be a profitable undertaking is quite another matter. The conditions essential to the production in all their perfection of some of the most beautiful colors are such as are not attainable except with a very large expenditure of money, and in circumstances which do not exist in private houses or even in ordinary workshops. In such cases the requisite expenditure could only be profitable with production on an extensive scale and where part of the necessary "machinery" is utilizable for other purposes besides mere color-making; and the circumstances, which include, among other things, the obtainment, perception, and maintenance to a nicety of different degrees of heat in furnaces of special adaptation are not to be found united except in factories devoted to the business.

(*b*) *Flux.*—But these are not the only considerations. A very great difficulty in

the way of attaining perfect success in color-making is the adjustment of the flux. Indeed, it is scarcely too much to say that this constitutes the nicest and most delicate part of the whole process. 1. The flux should be suited to the pigment as regards the composition of the latter; 2, it should be proportionate in quantity to the pigment according to its nature; (3) it should uniformly cohere with the glaze of the ware beneath; and, 4, the different fluxes, whatever their composition, should always vitrefy at one uniform temperature. The degree of nicety to which this adaptation must be carried will be appreciated when it is stated that an excess in one of the ingredients only amounting to between ·3 and ·4 per cent. of the flux may destroy the color.

Speaking generally, then, it is not to the amateur's interest to endeavor to be his own color-maker. To expend dollars on a furnace when for as many dimes he may get as much color as will in the ordinary way last him for some years, will not *pay*. Of course there are a few colors which may be made at home, but even as to these I am inclined to doubt that the domestic manufacture of them would be profitable except as a pastime, seeing that those most easily made are among the cheapest. There are published recipes on the subject which may be consulted by the amateur desirous of trying his hand in this line; but apart from the consideration that some are scarcely intelligible in modern strictness, and others are known to be incorrect, I think I have said enough to show that, except in a few cases, *le jeu ne vaut pas la chandelle.*

36. *Employment of Different Makes in one Painting Unadvisable.*—The point (4) noticed in the last paragraph but one demands further attention as bearing greatly on a very practical consideration. It is essential to the "finish" of a picture that after the firing all the colors should be equally glossy, and should have equally and completely adhered to the glaze of the ware. This end, so far as the painter is concerned, is, as a rule, to be attained by the use in any one painting of the colors of *only one* maker. It is the fact that there is one recognized standard of heat for firing enamel colors, and at this heat, technically known as "rose-color" heat, the color should be developed in all its perfection; but, unfortunately, it is not always the case that colors of *different* makers will fire properly at one heat. In these circumstances it is with pleasure and confidence that I recommend for general use the colors which I now employ, after an experience of those of three other makers, viz., those of the manufacture of Messrs. Hancock & Sons, of Worcester, Eng. Of these I cannot speak too highly. The grinding of them is complete, they do not concrete, they all vitrefy and develop equally, and, a not unimportant point as regards price, the quantity in the No. 2 sized bottles compares very favorably with that offered by other makers.

37. *Dry* v. *Moist Colors.*—These are now issued in the forms of dry powder, oil medium paste, and moist water-color. The relative worth of dry and oil-paste color has been much debated, but it is sufficient to say, that while it must be conceded that there is on first opening a fresh tube of color mixed with an oil medium, some advantage in respect of convenience, it is undeniable that in every other respect the advantage is on the side of the powder color. I cannot do better than give some of the "reasons" of the firm for originally deciding upon powder color:—

"I. Professionals know from experience that the sooner colors are used and fired after mixing with oils, etc., the brighter and better they will be when fired.

"II. Dry colors may be mixed thick or thin as they are required; whereas, if tubes are used and the color is too thin, it is difficult to make it stiffer for any particular purpose," without at the same time running the risk of having the mixture too fat. [A. de V.)

"III. Colors kept in tubes are apt to separate from their oils, if kept any length of time, thereby necessitating the trouble of re-mixing with a palette-knife (as much trouble as mixing in the first instance).

"IV. There is considerable uncertainty in producing, by mixture of various tube

colors, a given tint, for grounds, etc., particularly for large work, as they vary in consistence, and are therefore difficult to measure; whereas, the proportions of dry colors may be correctly weighed, and if a memorandum is kept, the exact tint may be reproduced with certainty, without further experiments.

"V. Moist colors in tubes are apt to become in time, what is technically termed 'fat,' which makes them liable to blister in the fire. Dry colors may be mixed with as little fat oil as experience proves necessary for the particular kind of work in hand, and the artist has it in his power to render them 'fat' or 'cutting, according to the requirements of his work, at the moment."

It is claimed too that the purchaser of dry color has this further advantage: that he obtains so much of the dearer pigment in place of the cheaper medium; and certainly, taking quantity for quantity, a comparison of the prices of the No. 2 sized bottles with those charged by other makers for moist colors, fully supports this claim, and this should be a leading consideration with the amateur, who may save not only the maker's cost of mixing, which is a very simple operation, but also his interest on such cost.

I may add to the foregoing "reasons," that in a foreign moist make which I have used, I have found tubes from which it has been impossible to express the paint, which had become as hard as a rock.

(To be continued.)

Christmas Greens Botany.

BY A. W. ROBERTS.

TO one who has his eyes wide open, much that is instructive and interesting in botany may be learned at any of our large markets during the two weeks preceding Christmas; for next to the big and little Christmas trees, comes the loose Christmas-greens, roping, etc., etc., that are used. In this branch of Christmas greens much interesting information is to be gained, as, for instance, the fact that large shipments of the English mistletoe are received through the Custom House some two weeks before Christmas. This English mistletoe is eagerly bought up by our English, Scotch, Welsh, and German adopted citizens. In habit the mistletoe is a true parasite, and feeds on the sap of the tree on which it grows. The fruit of this curious evergreen consists of a semi-transparent berry, the flesh of which is very sticky, and contains a single seed. The favorite trees of the mistletoe are the apple and oak. So much is this the case with apple trees in some parts of England, where they are cultivated extensively, the mistletoe has become the great pest and destroyer of the apple orchards. But the most curious fact regarding the planting of the seed of the mistletoe is, that it is entirely due to the birds of England that remain in that country during the long winter months; these birds being hard pressed for food, are forced to feed on the sticky berries of the mistletoe, the seeds of which they leave sticking to the branches of the tree on which the mistletoe is growing. These seeds, in course of time, germinate and live on the sap of the tree. As the English mistletoe does not grow in the North of England or Scotland, florists are in the habit of planting the seeds of the mistletoe on young apple and oak trees, and, when the mistletoe has attained a good size, the trees are disposed of at high prices, they being a great curiosity in Scotland and the northern parts of England. The mistletoe was greatly venerated by the ancient Britons, and was considered by the Druids as an absolute and sacred charm against disease and misfortune, the priests at certain seasons of the year, with great solemnity, gathered it from the oak trees with a golden sickle. The ancient custom of kissing under the mistletoe bough during Christmas times, has been handed down since the feudal times. The leaf of the English mistletoe is long and graceful in shape, whilst that of our native mistletoe is short, rounding and clumsy looking; of this variety large quantities are gathered from the live oaks of Florida to be disposed of in the northern markets during Christmas time. From the berries of the mistletoe, the very best of

bird-lime is made by the young naturalists of England, who, being desirous of obtaining the birds of their country in

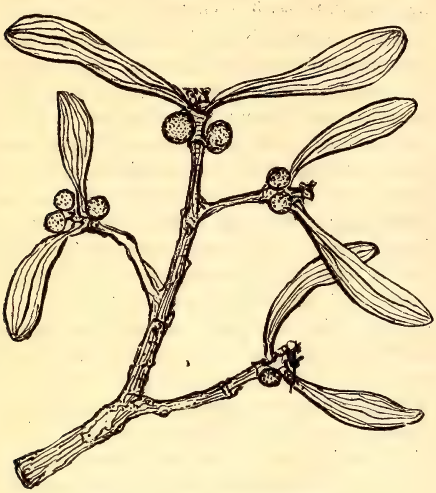

Fig. 1.—ENGLISH MISTLETOE.

their most perfect plumage, make use of the bird-lime in preference to shooting them, which often destroys valuable specimens.

Fig. 2.—AMERICAN MISTLETOE.

One of our most common of Christmas greens, and which is used mostly for the making up of "roping," is the "ground-pine." This beautiful evergreen belongs to the family of club mosses or Lycopodiums of the botanists, and by the florists called "bouquet greens," as large quantities of it is used by them during the winter months for making up bouquets when other green material is scarce. When the flowers of the ground-pine are ripe, they are collected and dried, after which they are shaken and sifted to obtain a powder of a sulphur-yellow color which is the spores of the plant. This curious powder is sold by all druggists, by the name of *Lycopodium.* When in a mass, it is very mobile and smooth to the touch. Druggists use this powder when making pills to prevent them from sticking together; and also in cases where a person's skin has been badly rubbed off through some accident, this curious powder is dusted over the wounded part to which it adheres, and forms an artificial skin. There are other curious qualities possessed by this powder, as for instance, if the surface of a bowl of water is dusted over with it, and also some of it be rubbed over the hand, a piece of money or other object when placed in the water, can be removed from the bottom of the bowl without wetting the skin, the powder seeming to possess a negative or repellant quality to that of water somewhat like oil or other greasy substances. Another interesting quality possessed by this powder, can be illustrated by placing a small quantity of it in a quill or paper tube, or what is still better, in a syringe. Then if the powder be discharged against a candle or gas light, it will produce an instantaneous flash like that of lightning.

The ground-pine sells readily to florists at three dollars a barrel, who generally make up their own Christmas roping. Common roping can be purchased as low as two cents a yard, but it is very thin and apt to fray out in a short time. The best roping sells for five cents per yard. Thousands and thousands of yards of this material are used every Christmas for home, church, and Sunday-school decoration. The larger part of it comes from New Jersey, packed in barrels, which, when kept in a cool and damp

place, will retain its beautiful green color for several weeks. A few weeks before Christmas, hundreds of poor boys and girls are hard at work gathering and winding the ground-pine into roping, and by this means earn enough money with which to purchase warm winter clothing or pay off the taxes on some

Fig, 3.—GROUND-PINE.

small fruit farm. So my merry young readers, when you are festooning your homes or Sunday-school room with this beautiful Jersey evergreen, think how very many little girls and boys have been made happy by gathering and making it up for the boys and girls of New York City.

From Florida large quantities of Spanish moss are sent north a few days previous to Thanksgiving and Christmas. This beautiful moss answers a double purpose. First as a soft and dry material in which to pack the luscious Florida oranges, and also that of a beautiful and graceful evergreen for Christmas times, the cool greyish-green color of which contrasts well with the rich dark greens of our northern evergreen. This curious Spanish moss, as it is called (though it is not a true moss at all, but belongs to the pine-apple family or the *Tillandsias*), has also a considerable commercial value, it being used very extensively by upholsterers for stuffing mattresses, sofas, etc. The process of preparing the moss so as to rid the inner, woody, horsehair-like fibre of its soft outer coating or "bark," is a very slow and tedious one. After gathering it from the trees of the live-oak on which it grows (for like the mistletoe, it is a parasite, though it does not live on the sap of the tree as do the mistletoes, but obtains its support from the moisture of its surroundings and the atmosphere), it is buried in the ground, or is placed in running water, where it is allowed to remain until the outer covering or "bark" is more or less rotted; it is then dried and beaten, and baled, after which it is sent north to be ginned. The

Fig. 4.—FLORIDA MOSS.

ginning removes all small particles of "bark" that still remain attached to the fibre, and at the same time, clears it of dust and foreign substances. It now looks very much like coarse and black horse-hair, and when in a mass, has great spring to it, almost equal to curled horse-hair, and is worth fifteen cents a pound. You would never recognize this material as the once beautiful Spanish moss of Florida.

The holly with its beautifully shaped leaves, and clusters of bright crimson berries, is, undoubtedly, one of our most attractive evergreens, but the leaves soon lose their vivid green when placed in a dry and hot room, otherwise it would outrank all our native evergreen trees. Last year several cases of English holly were sent to New York dealers as an experiment, but it proved to be a failure, in consequence of the leaves falling off after their long journey across the Atlantic ocean.

The best bird-lime for catching birds, mice, and other small animals, is made from the middle bark of the holly, which is well bruised and boiled in water for four or five hours. The water is then poured off, and the bark is placed in pits dug in the earth, and covered with stones. At the end of a fortnight or three weeks, it will have changed into a sort of mucilage by the action of fermentation; it is then pounded in a mortar until reduced to a paste, washed and kneaded in soft water to rid it of all earthy or vegetable matter; it is again placed in the earthen jar for four or five days to purify itself by fermentation, after which it is put up for use. Thousands of young holly trees are manufactured every year into walking canes; they are stained a deep black in imitation of ebony, and the wood being close and heavy, very few people know the difference when highly polished.

Fig. 5.—THE HARTFORD CLIMBING FERN.

The "climbling fern" or "Hartford fern," is one of the most beautiful of all our native ferns. The striking delicacy, beauty of foliage, and graceful habit of this fern adapt it to decorative purposes in its green state; or when carefully pressed and dried, it is formed into graceful festoons and attached to white curtains, or draped around pictures. Thousands of sprays of this fern are gathered and pressed every year to be disposed of by florists during Christmas times. So great became the demand for it, that there was danger of its becoming extinct in the locality at East Windsor Hill, Connecticut, where it grew in great abundance. So large were the quantities taken away yearly, that an act was passed by the Legislature forbidding its wanton destruction. There are two methods of drying and pressing this fern; one is known as the "dry pressed," and the other as the "hot pressed"; the "dry pressed" consists in placing the ferns between sheets of paper or dryers, which are changed every few days. The "hot pressed" is where all moisture is evaporated from the ferns by means of hot flat irons, which are rapidly passed over the ferns; the dry pressed ferns always retain their colors best.

A Skate Foot-Scraper.

SINCE the advent of the beautiful strapless skate, thousands of the old-fashioned "turn-ups" and English skates with their numerous straps and buckles, have been cast aside. In my travels I have come across them hung up in woodsheds, cellars and barns, rusty and uninviting

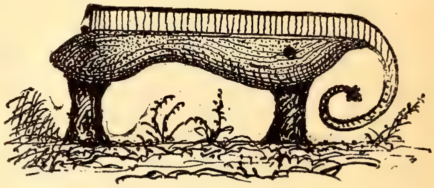

Fig. 1.

looking. No one cared to destroy them, as they had been in the family so many years, and yet there seemed to be no useful way of disposing of them. Having just such a rusty and mouldy pair of "turn-up" skates in my possession since

early boyhood days, I determined to turn them to some account, and yet preserve them as souvenirs of happy boyhood days. After taking away from the body of the skate all the heel and toe-bands, and straps, I burned four holes wit' a heated wire poker through the wooden foot piece of the skate; through these holes were introduced four long screws, which were screwed into the two hickory or chestnut stakes, or uprights shown in the illustration, Fig. 1, these stakes having been first firmly driven into the ground. After the skate was firmly screwed in position on the two upright stakes, both it and the stakes received two coats of green paint, and the result was an excellent scraper for taking mud off boots and shoes.

Fig. 2 shows how an old gate or barn-door hinge may be utilized for the same purpose. This shows one wing of a strap hinge run through two upright pieces of wood. The mode of construction and means of fastening, are quite obvious.

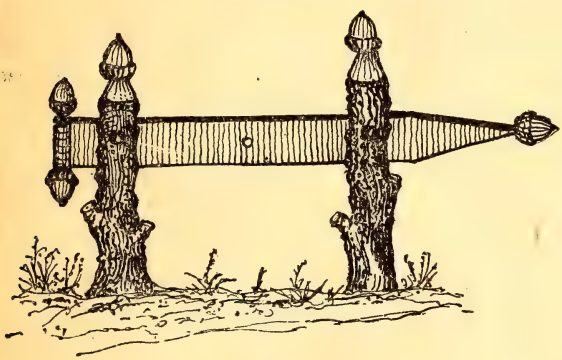

Fig. 2.

Canaries: How to Keep and Breed Them.—V.

BY GORDON STABLES.

CANARIES can be taught a variety of little tricks after they have come to love you. They may also be taught the notes of various other birds, or they will learn tunes played to them on a bird-organ or flute or violin. In either case they must be taught while young, and they must be so placed that they can hear no sounds save those you wish to teach them.

Cats, I may just remark, should be taught to respect your birds. Pussy often gets extremely attached to canaries, and will protect them, but never think of hurting them. I have seen a canary placed in a cat's pen at a show to keep pussy company and sing to her.

Let me conclude by mentioning a few of the ailments canaries are liable to, though these can mostly be prevented by avoiding their common causes, namely, 1, damp; 2, draughts; 3, want of ventilation; 4, the abuse of dainties; 5, bad food; and 6, impure water.

Asthma.—A little glycerine in the water, with a rusty nail, and fifteen drops of tincture of gentian.

Diarrhœa.—Two drops of warm castor-oil first. After a few hours, a small bit of gum arabic, and about twenty drops of tincture of opium in the water, or a little of the ordinary chalk mixture of the shops.

Constipation.—This is a complaint which is more easily and successfully treated by change of diet than by medicine. Give more green food in summer, and in winter a slice of ripe apple or well boiled carrot. If the case is urgent, give two or three drops ofcastor-oil.

Inflammation of the bowels.—The bird is dull and drooping, perhaps lying on its belly on the perch, and evidently in great pain. The lower part of the stomach will be found red and swollen. Give a drop or two of castor-oil to begin. Paint the abdomen, by means of a camel-hair brush, with warm turpentine. Put in the drinking water twenty drops of wine of ipecacuanha, and a bit of gum arabic; or put a drop of each of the former medicines, diluted in two or three drops of water, down the throat thrice a day. Keep warm and handle gently. When the bird begins to come round, feed on steeped biscuits of arrowroot and sweet milk.

Fits.—Fright often brings these on, and the bird may die in one. Hold the sufferer in the open air; blow on it and sprinkle it with water, but do not do this for about a minute after it falls down. The heart cannot recover suddenly. Hanging the bird in the sun or too near the fire may induce apoplectic fits. They are highly dangerous. Take the bird to the cool fresh air, and endeavor to get it to inhale the aroma from a smelling-salts bottle. It will come round gradually. Be careful with your feeding afterwards.

Cramp.—Open the bowels with castor-oil, then put a few drops of paregoric in the daily drinking water. Change the diet; it must not be too stimulating.

Pip.—A name given to a small pimple on the rump. Open with a fine needle when matter is apparent, then dress with cold cream.

Sore feet.—Clean and wash, and anoint with cold cream. Turn the bird into a clean dry cage, then thoroughly do out the old one.

In all cases of illness examine the bird, holding it gently but firmly the while all over. A change of diet is always necessary in sickness, and more warmth. Put the patient in a comfortable well-ventilated room, and see that it wants for nothing needful.

Answers to Guesses.

THE following answers have been handed us in reply to the calls for "guesses" made last month. The answers are correct in each case.

We should be pleased to have the readers of the YOUNG SCIENTIST take a part in this column, as we are sure they may make it both interesting and instructive.

Answer to No. 1.—Meal-worms, sold by all dealers in birds. Used as a special

MEAL-WORM.

food for all the soft-billed birds, mocking-birds, thrushes, sky-larks, etc., etc.

Answer to No. 2.—Tree-toads, kept in glass jars as pets. When a storm is coming, they climb to the top of the ladder, and begin to trill. All Germans are very partial to them. The green variety, common to all Germany, is known as the barometer-frog, and is kept as a pet.

Answer to No. 3.—Our common yellow bird. By depriving any wild bird of its flight feathers, and allowing it the freedom of a room, in course of time it ceases all attempts to fly away; but, when its flight feathers grow out again, off it goes.

Answer to No. 4.—Gathering angle worms. The first man sold them for rum to liquor dealers, who had pet robins or mocking-birds. The second man who gathered them for his pet, had a pet thrush. The fourth man, to use as fish bait on one of the East-River docks, where the lafayette fish were very abundant at the time. He was out of work and out of money, but took this means to provide a breakfast for his family.

Plan for the Furnishing and Decorating a Young Lady's Apartment.

WE will suppose the apartment of a young girl from thirteen to eighteen years of age, decorated with mural hangings in the form of panels of white muslin plaited over a painted design, and enframed in a puffed border of some light material, such as silk, and tufted with small buttons embroidered with braid. This style of decoration is quiet to the eye; the lines are light, simple, and elegant, and the effect produced by the painted design being seen through the folds of the clear muslin, gives an effect suitably fresh and childlike. Bows of ribbon and such like ornaments should have no place here, appertaining, as they undoubtedly do, to a later stage of feminine coquetry, and, though every article in the apartment should display the most *recherche* taste, quietness and simplicity should be the most striking characteristics.

The ceiling is to be hung in the same style as the walls, and composed of an oval and four corners, surrounded by a tufted bordering or frame like the walls. A separate flap of muslin over a painting replaces the cornice in this style of decoration, and at the bottom of this flap is a narrow band of gathered muslin falling over the top of the hanging. The chimney-glass, to be in keeping with the rest, is surmounted by a drapery of clear muslin, the folds of which, draped on either side, replace the tufted frame of the other sections. The dainty bedstead has flowing white double curtains, the interior ones covered with a light embroidery, and the outer ones edged with a narrow drapery forming insertion work.

A plaiting of white muslin, radiating

from a centre, in the shape of a sun, extends over a painted design, and forms the ceiling of the bed.

The coverlit is also composed of embroidered muslin to match the inner curtains. The drapery of the windows and *portieres* must correspond in material and design with that of the bed, with a heading of ruching and small gobelets above each fold, and gathered in the space between each gobelet.

The rest of the suite of this apartment is a cheval-glass or mirror wardrobe, a small secretaire or writing-desk, a night-table, a prie-Dieu, a small sofa, a *chauffeuse* or lounging-chair, and four other chairs of a light and elegant form, simple in effect, not to be out of keeping with the general result.

The execution of the decoration we have just described, though very simple, requires nevertheless great attention and care, especially in the taking of the measures. A plan rigorously adopted on the scale of proportion facilitates the work to be done to a very great degree; for it is only by means of this precaution that the excellent French maxim, "Before driving in the first nail it is well to know where you will drive in the last one," can receive its practical development.

With regard to the frame of the panels of this style of hanging, it is usually of strong card-board, or, better still, of wooden laths about a little more than half an inch in thickness each, and thinned off at the extremities. When this frame has been well adjusted to the exact measure required, a piece of strong linen should be glued over each joining, which gives a great deal of solidity to the whole. The frames of the ceiling and of the separate flaps should be formed of lath somewhat thicker than those that compose the frames of the panels. When all has been well adjusted according to the required measure, the tufting is traced and the frame bored with a gimlet at the place marked for each section of the tufting. This done, a layer of good horse-hair of about $1\frac{1}{2}$ inch in thickness, and over this one or two layers of wadding over the whole extent of the frame. Then the material used for covering the frame is prepared, that is to say, the corresponding number of sections with those on the frame, traced on the reverse side, with sufficient amplitude allowed to each section of the tuftings, and the material pierced with a bodkin at each section to mark the corresponding hole in the wood-work of the frame. Thus prepared, the material is placed over the wadding without being nailed down. Then the braid is placed on the material, and tightened as much as possible, and in such a way that the braid be exactly on the trait made on the frame. Then tuft with a fine needle, passing it through the holes in the woodwork and the material, the thread *passing over* the braid, and rather tightened. When no buttons are used, braid replaces them in this style of tufting, and gives considerable lightness in the general effect.

This tufting being executed, the material is turned down and nailed just on the edge of the frame if a gimp be used as binding, or below the edge if a cord.

With regard to the panels, after the execution of the frames which we have previously described, the painted designs having been carefully and smoothly hung in the places marked out for them, the muslin, or, better still, the grenadine panels (grenadine being at one and the same time much more transparent and durable than muslin) are simply gathered top and bottom, with an allowance in fulness of one-third to the whole—in other words, one-half over and above. Thus prepared, the muslin is now tightly stretched over the painted design, and in such a manner that the gathers are very straight and parallel with each other and as numerous as possible. The frame is placed and fixed to this, and a cable or light twisting of the material, silk or other, employed in the hanging surrounds the whole, producing an effect which is almost sure to be admired for its dainty elegance, novelty, and simplicity.

It will be understood that the painting to which we have referred should be both designed and executed with proper reference to its effect when treated in the way described.

The framework of the ceiling is prepared in the same manner, with due reference to the point from which it will be examined when completed.

We have a very important observation to make here with regard to the cutting destined to cover the separate flaps. All the gathers of this piece of muslin converging to one point, consequently become larger and larger as they approach the angles. To trace the cut of this muslin, a tracing of the real dimensions of the flap should be first executed; divide the line of top and bottom into a given number of equal parts with not too much space between: join the corresponding points at top and bottom by lines. These lines will, of course, become larger and larger, parting from the centre, and will be a certain and sure guide for the development of the muslin by proceeding as follows:—

Draw a straight line equal in length to one length and a half of the length of the top of the flap; divide this line into as many equal parts as you have divided the first tracing. From each point of division of this line (which represents

the straight thread of the muslin which is to be gathered at the top of the flap) drawn down perpendiculars, the length of which will be given by the corresponding lines drawn from top to bottom of the first tracing, the extremities of these perpendiculars deciding the direction of the cutting-out, which forms a curve. If each part of the top and bottom be gathered carefully and with regularity, the result cannot fail to be satisfactory.

We have been induced to present this type of decoration to our readers, in the hope that they may derive advantage from the directions and suggestions we have given, which will be found applicable on many and divers occasions besides the present one. In Paris upholstery decoration for such apartments has been extensively adopted, and we have seen similar effects carried out in both Germany and America, with certain modifications and variations, to which we may return on another occasion.

Our Girl's Department.

This department is intended exclusively for "Our Girls," and we hope to make it both interesting and instructive, and to this end we ask our young lady readers to assist by contributions, suggestions, or illustrations. There are thousands of little things that can be, and have been, made and done by young ladies, pertaining to decorative art, needlework, etc., etc., that would be gladly followed but for a want of knowledge on the subject, and we know of no more pleasing task for a lady than that of teaching her younger sisters that which they are anxious to learn, and which may prove of real benefit to them in the future, as well as being useful and interesting for the present. We trust we will have no difficulty in persuading those who have something nice to show or speak of, to make use of this department. Remember, it is open to all, and if you have anything worth knowing suitable for this column, send it along, and we will give it our best attention. Do not be afraid to write because you may fancy your composition is not perfect, or have other scruples of a similar kind. Do the best you can, and leave the rest to the editor of this department, and we are sure you will be pleased with your work.

Brown-eyed Ruth, the Quaker's daughter,
In her dress of simple grey,
Walked beside her quiet grandpa
'Mid the garden flowers of May.

Bed of tulips bright and golden,
Hyacinths of every shade,
Pansies, like sweet childish faces
Looking up to greet the maid.

How they revelled in the sunshine,
While 'mid clumps of violets blue,
Filling all the air with fragrance,
Glistened still the morning dew.

Then outspoke the little maiden,
Looking at her dress of grey,
"Grandpa, can thee tell t e reason,
Why God made the flowers so gay,

"While we wear the quiet colors
That thee knows we never meet,
E'en in clover or the daisies
That we trample under feet?

"Seems to me a Quaker garden
Should not grow such colors bright."
Roguishly the brown eyes twinkled
While her grandpa laughed outright.

"True it is, my little daughter,
Flowers wear not the Quaker grey;
But they neither toil nor labor
For their beautiful array.

"Feeling neither pride nor envy,
'Mong their sister flowers, thee knows,
Well content to be a daisy
Or a tall and queenly rose.

"Keeping still the same old fashions
Of their grandmothers of yore;
Else how should we know the flowers,
If each spring new tints they bore?

"Even so the Quaker maiden
Should be all content to day.
As a tulip or a pansy,
In her dress of simple grey."

Once again the brown eyes twinkled;
"Grandpa, thee is always right;
So thee sees, by thy own showing,
Some may dress in colors bright.

"Those whom thee calls worldly people,
In their purple and their gold,
Are no gayer than these pansies
Or their grandmothers of old.

"Yet thee knows I am contented
With this quiet life of ours,
Still, for all, I'm glad, dear grandpa,
That there are no Quaker flowers."

— Twenty-five years ago there was sold in Milan a library of 30,000 volumes, all of which were of woman's authorship.

— In Nebraska there is one woman who is an ordained preacher of the Gospel, ten who are physicians, one lawyer, and six who are county superintendents.

— The Queen of Denmark, mother of the Princess of Wales, is an accomplished painter, and has lately presented the little villiage of Klitmoiler, in Jutland, with an altar-piece, entirely executed by her own hands.

— A portrait of Ignatius Loyola, in needlework, the work of French nuns, has been shown at an exhibition. It is only about six inches long, and was worked entirely in knots so fine that the stitches could not be seen without a magnifying glass.

— Mrs. Susan P. Moulton, of Salem, has received a patent for a railroad shackle which is very simple in construction, effective in operation, and if put in general use it is believed would cause a great diminution in the number of accidents in making up a train.

— Miss Mary E. Lovejoy, of Bangor, Maine, is quite largely engaged in the silk business. She has at present 3,000 silk worms. In thirty days from hatching the worms begin to spin, and in nine days more the cocoon is ready to be reeled and spun. It is thought that the silk raising business can be made profitable in Maine.

— Mrs. E. A. Burke, wife of Major E. A. Burke, editor of the New Orleans *Times-Democrat*, has accepted the superintendency of Lafayette-square, the most beautiful spot in that city, whereupon the New Orleans papers are rejoicing, as Mrs. Burke is a public-spirited lady, and will discharge the duties of the position faithfully.

— The town of East Turner, says the Lewiston (Me.) *Journal*, is bragging about a smart girl. The young lady's name is Eva French. She is 16 years of age. In consequence of scarcity of help in the haying season, Miss French, whose father is one of East Turner's well-to-do-farmers, put on her broad-brimmed hat and went into the hay-field. She has this summer driven a pair of horses on the mowing-machine to cut twenty-five acres of grass, and has raked the same with a horse-rake and pitched it into the barn with a horse pitchfork. The farm cut nearly forty tons of hay. In addition, Miss French can bake as good a batch of biscuits or do housework as well as any housewife in Turner.

BEFORE QUESTIONING THE POP.

Sighed the slim to the belle, "Aw, miss, can you tell
Why I'm like that apple you plucked from the tree?"
"Because it," she coughed, "is remarkably soft?"
"Aw, no; it needs paring by you," stammered he.

"Re-pairing, you mean, though because it is green,
And rather insipid, might answer," laughed she,
"And not fully grown." Said the dude, with a groan:
"Aw, were I that apple, perhaps you'd halve me."

"And quarter you, too. Oh, for 'sauce' you will do,"
Spake the miss; "but, now tell me, why you're like the tree?"
"Because—I've a heart," blushed the slim, growing smart.
"Because—trees are sappy and crooked," said she.

"Aw, you're," smiled the slim, "like the tree for you're woo'd."
"You'd better say 'bored,'" said the miss, "as I'm now;
But trees, you perceive, make a bough when they leave,
So you, to be like them, may leave with a bow."

— "Who grasps the moment as it flies, he is the real man." There is a good deal of food for thought in this short sentence for every wife and mother who reads this column. To grasp the right moment in our lives is of so much worth to us; to enjoy the prattle of our children even in the midst of daily anxieties and all the hurry of a busy life; to take the time to smile an answer with the kindest words the friends who sometimes interrupt our work, and, as we are apt to say, waste our day. How much better to do this now rather than to cry out in later years for the impossible; to say, "Oh, for one hour with my little children!" when they have become men and women, and are beyond our reach, and we are left remembering the many hours in which we were not patient with their little hindering ways, and in which we did not grasp the possibilities of happiness. Then, in very homely ways, to grasp the flying moment is profitable; to care for all the material interests of the house-

hold when they should be cared for; to put up the ripe fruit before it has time to soften; to mend the little holes in stockings, the rips in gloves. If women who have work to do would not waste time in useless fretting about the unchangeable nature of their work, they would gain in time and strength.

— Engagement rings are the natural sequences of the summer campaign of the belles of the watering-places, and many a young man is at his wits' end to raise the necessary cash wherewith to secure the preliminary token of future domestic bliss. Ice cream, drives, boating, and pleasure excursions generally have depleted the pockets of the devoted beaux, and in many instances when the question, the momentous question, was asked, it was with fear and trembling that the expected answer was received. On leaving, the happy girl generally says:—"When you get me my ring get me a nice one, Charley, for I want to be proud of it, and all the girls will criticise it, you know. Get a nice solitaire with a skeleton setting, so the diamond will show nicely. I think a pure white stone is the best. That hateful Laura has a colored one, and I believe it is full of flaws. She is always showing it, anyhow, and if she hasn't a scratch on her finger she is continually fixing her hair or arranging her collar. I want a better stone than hers. Won't you get it, dear?"

"I will, darling; I'll get you the best in the market," and he departs with a sinking heart.

The next day he makes an arrangement with some jeweller by which he gets an inferior stone at a high price, which he pays for in weekly instalments. Visits to his girl and the usual presents and theatricals take the remainder of his salary, and when the wedding-day approaches his or her fond parent is obliged to hand over the necessary funds to unite the twain and send them off on their bridal tour. On their return they generally settle down, and the question of the engagement-ring and the attendant incidents form a subject of jocular conversation between them.

— Fifty females employed in the Mint at San Francisco are called adjusters, and their pay is $2 75 a day, counting week days and all holidays but Sundays. Their hours are from 8 o'clock in the morning until 4 in the afternoon, with the exception of Saturdays, when they cease at 2 o'clock. These adjusters occupy two large rooms on the second floor of the Mint. One is used for the adjusting of silver and the other for that of gold. The floors are carpeted, and each lady has a marble-top table, a pair of scales, and a fine, delicate file. Before the gold is turned over to them to be adjusted it goes through the process of being rolled, annealed, cut, and washed. They then take it in a state called "blanks," that is, perfectly smooth, and the weighing is done. It is weighed to see if each piece be of standard weight, which must be of 412½ grains for a silver dollar, a slight discrepancy being allowed on either side. If a coin is found outside of the limit after being weighed by an adjuster, it is returned; if too light it is condemned, and must be remelted; if too heavy, it is filed to its proper weight. This is the ladies' work, and an interesting sight it is to watch the small white fingers deftly handling the shining pieces. A room near the adjusting room has been set aside for the ladies, who use it as a lunch room; two long tables are provided, and a janitress furnishes boiling water for making tea, and also keeps the place neat and clean. Several of the ladies have been in the Mint for several years

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DICTIONARY OF OSCULATION.

Buss, a kiss.

Rebus, to kiss again.

Pluribus, to kiss irrespective of sex.

Syllabus, to kiss the hand instead of the lip.

Blunderbus, to kiss the wrong person.

Omnibus, to kiss all promiscuously.

Erebus, to kiss in the dark.

Incubus, to have to kiss some one you don't like.

Harquebus, to kiss with a loud smack.

THE

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A Practical Journal for Amateurs.

(With which are incorporated "THE TECHNOLOGIST," "THE INDUSTRIAL MONTHLY," and "HOME ARTS.")

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EDITORS.

JOHN PHIN. FRED. T. HODGSON.

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Free! Free!! Free!!!

SEE WHAT WE ARE GIVING AWAY TO EVERY SUBSCRIBER.

THE success which has attended our efforts during the past year, since the enlargement of the YOUNG SCIENTIST, has determined us to make it still better during 1884. We are now completing our arrangements for accomplishing this—making contracts with contributors, engravers, paper makers, printers, and others—and we are anxious to get our subscription list into shape as soon as possible. We have therefore determined to make the following tempting offer: To every one that sends to this office a subscription for 1884 at full rates, before the 1st of January next, we will send a copy of the "Workshop Companion." This is a book of 164 closely-printed pages, full of matter that is just what every one of our readers, boys and girls, wants. The price is 35 cents, strongly and neatly bound, so that those who accept our offer get the YOUNG SCIENTIST for almost half price.

If you want a copy of this work on these terms, send at once before you forget it.

Subscribers will oblige us very much by sending in their remittances before the first of the year, as by doing so, we may keep their names on our books without change, thus saving us a great deal of trouble.

Boys who are fond of reading the story papers which contain such impossible tales, should try and change their reading, and for the sake of variety, if for nothing else, read some of the following works which we are sure they will find as interesting and much more instructive than anything found in the weekly story papers. Besides, the works named, are such, as every wise person will approve of, and which no parent or guardian will object to; and when we consider that a boy's reading is the most important part of his education, it is a matter worthy of our best attention to have placed in the hands of boys, books that will aid, rather than retard their acquirement of knowledge, and that will be at once both useful and elevating. If a boy takes kindly to sea stories, get him a "Biography of Paul Jones," Southey's "Life of Nelson," or Cooper's "History of the American Navy." After reading these he may be permitted to read "Cooper's sea tales" and Marryat's novels, books that are much healthier than most of the rose water sea stories of the present day. If a boy desires reading of a stirring kind in another direction, let him try one of Mr. Towle's series of books about the "Heroes of History," or Dr. Eggleston's "Lives of Famous Indians," and the reading of these will surely lead the boy on to a desire to know more of the "Heroes" and "Indians" of whom he reads, and then his mind will be ready to take in solid history with enjoyment and profit.

Among other works which the intelligent boy will enjoy, may be mentioned, "Robinson Crusoe," "Arabian Night's Entertainment," "The Swiss Family Robinson," "The Percy Tales" for short readings, "Tales of a Grandfather," "Tales of the Border," "Magna Charta Stories," by Arthur Gilman, and many others of a like nature.

Every book noticed in the present and

previous issues of the YOUNG SCIENTIST, may be placed in the hands of young people with safety, for we shall not notice any book in our columns of which we may have doubts as to its fitness to be read by our younger patrons. Any of the books we have named in the foregoing, when read by an intelligent boy, will prove just as interesting as any of the "HORRIBLE-EYED BILL, OF MURKY GULCH," kind of stories, and much more elevating and instructive.

Seldon informs us that the Christian Church, desirous of abolishing the Saturnalia of the Romans, a festival instituted in honor of Saturn, appointed a festival in honor of Christ, to supersede it. But the observance of the day did not become general until about the year 500. Many curious myths are told concerning Christmas eve, such as that if we go into a cow stable at 12 o'clock at night, we shall find the cattle kneeling; and if we visit bee hives at that time, we may hear the bees singing Christmas Carols to welcome the approaching day.

We deck our houses, schools, and churches with evergreens to remind us of the birth of the great Founder of our Church.

The laurel is used with other evergreens at Christmas, because of its use among the ancient Romans as the emblem of peace, joy, and victory.

The mistletoe is used in all Christmas decorations by the English. Its berries and its green are very beautiful. A full description of it is given in another column of the present number. A branch of the mistletoe is often hung over the doorway on Christmas eve, and if a gentleman can kiss a lady as she passes under the mistletoe, he has on *that* evening a right to the privilege.

The evergreens mostly used in this country are hemlock, spruce, laurel, Canada balsam, and the varieties of ground-pine. The bright red bitter-sweet berries gathered in the fall, add to the beauty of the wreaths.

We have frequently been asked the meaning of the initials affixed to crosses used on that day, such as I. H. C., and I. H. S. The former stands for these Latin words: "*Jesus Humanitatis Consolator*"—Jesus the Consoler of mankind; the latter, "*Jesus Hominum Salvator*"—Jesus the Saviour of men. On some very ancient crosses are found I. N. R. I., "*Jesus Nazarenus Rex Judeaorum*"—Jesus of Nazareth, King of the Jews.

The custom of giving presents at Christmas originated in Germany. It was derived from the ancient feast of Sol. The Christmas tree is of German origin also, and is, perhaps, the most pleasing way of giving presents to those we love.

Perhaps many of our readers will desire to make Christmas trees for their own homes, or for the schools or churches of which they are members; and it may not be amiss to offer a few suggestions regarding them: If the woods are not convenient where a suitable tree might have been found, and when it is necessary to purchase an evergreen from a nursery, a "silver fir" should be obtained if possible, as it is best adapted for the purpose. In large cities suitable trees are easily obtainable, as thousands of them are shipped there for sale. If woods are near, and free access may be had to them, and "silver fir" or "spruce" are not to be found, hemlock may be used; it is the prettiest green, but its branches are not sufficiently firm to bear any considerable weight. Branches may be nailed on here and there to make the tree symmetrical, and it may be trimmed if required. Slats may be used to strengthen the branches if necessary; but when this is done, they should be painted green with some non-poisonous paint mixed in rice water, or a weak solution of glue.

For the base of the tree, a half of a cask or barrel may be used, placing the greatest diameter on the bottom. A hole made through the end of the cask or barrel to admit the woody portion of the tree to pass through, and a brace nailed across the lower portion of the barrel with a hole in it for the foot of the tree to rest in, will make a solid base for the tree. A square box may be made to answer the purpose very well. If necessary, the cask, barrel or box may be screwed

to the floor. The base, whatever it may be, should be painted green, and covered with green moss and little branches of hemlock or pine. If paint is objectionable, green paper or cotton cloth may be used in place of the paint.

The tree, when completed, should be placed in a corner or the centre of the room, and have a white cloth spread under it, both to protect the carpet and to give brilliancy to the tree when the candles on it are lighted.

Pieces of tin cut diamond shaped, and hung thickly among the branches of the tree, will add much to its appearance. Tinsel and gold paper may also be used with good effect. Gilded glass balls and pendants, that may be obtained cheaply. Bright colored ribbons and variegated prints may be made use of with effect by any ingenious young lady or gentleman.

Indeed, when the tree is firmly set in place, the process of decoration may safely be left in the hands of the ladies of the household, who will, doubtless, make good use of all the advantages at hand, not forgetting the all-important Chinese lanterns, and the necessary wax tapers.

It is pleasing and encouraging to see that both pulpit and press are taking up cudgels against that bane of our young folks: "Dime literature." A few Sundays ago Dr. Crosby, in a sermon preached in his church, denounced the publication of the villainous stuff, and strongly advised parents to see that their children were provided with healthful reading. The following, which is taken from the New York *Telegram*, is to the point, and worth reproducing here:

"An interesting illustration of the manner in which dime novels act upon boy's brains has recently been given at Cleveland, where a boy aged fourteen was the organizer of a secret society, to be called 'The Society of the Silver Skulls.' The principles set forth by this delightful association included an unmitigated curse upon all those domestic and friendly relations which men hold dear, and the invocation of various appalling calamities upon whoever should prove a renegade. In the present age there is no reason why good and entertaining reading should not be furnished to boys and girls of all ages. Never has reading of this kind, intended especially for juveniles, so greatly abounded as at present. Never before have so many writers of talent, so many draughtsmen of skill and so many publishers of respectability, backed by money, lent their aid to supplying children with reading matter of the first order. The class of 'literature,' therefore, which comes under the denomination of the dime novel ought to die. Those parents must be very unwatchful or extremely foolish who can allow their sons to pursue a course of reading the tendency of which is to arouse all the worst instincts and extinguish all the best. The Cleveland youth recently disappeared from his home, taking with him two revolvers. This looks as if he were going to join either the cow boys or the Indians, a little fraternization with whom would perhaps dissipate his ideals."

ODD NOTES.

— Photography is one of the miracles of modern times. The art has taken strides with its seven league boots since the time of Daguerre, who made a picture on a metal plate, which had to be turned and twisted almost out of shape before you could find what you were looking after. Lately pictures have been taken with such rapidity that forked lightning is compelled to strike a faster gait to keep up with the process. Dr. Koch tells us that he has photographed with a photo-micrographic camera that most minute filament, the *flagellum* of the bacteria. One might be satisfied with photographing the bacteria as a whole, since it is beyond the reach of naked vision, but to take a picture of an insignificant portion of it is like getting up among fairy tales. Mr. Rockwood also has succeeded in getting satisfactory pictures of the vibrating point in the diaphragm of a telephonic instrument while a person was speaking at it, and by means of a spark from Leyden jars. The work must have been done in the one twenty-four thousandth part of a second. This rapidity

almost exceeds that with which a ward politician accepts office, and is only equalled by the readiness with which a poor girl accepts a rich husband.

— The sixth of a series of lectures by Professor Albert S. Bickmore was delivered on the 10th of November at the American Museum of Natural History. The lecturer took for his subject "Humming Birds." He said:—"Humming birds are only found in the New World. Their principal home is in Central and South America. A few, however, are found up as far as Hudson's Bay. Their favorite place is not in densely wooded forests, but in the open, where there are flowers and fruits. While this family of birds is confined to America, yet there are four hundred different kinds of them. They have two different motions of the wings—one producing the humming sound and the other propelling them the same as other birds. The humming bird lays only two eggs, which are not pointed at either end, but are elliptical. Humming birds take great care of their young. Frequently, when they are disturbed, the male will remove one egg and the female another to a different place."

The lecture was illustrated by a long series of photographic transparancies and by the collection of the museum, which is one of the best in America.

The subject of the next lecture will be "Pheasants and Doves."

— The annual fall games of the Athletic Association of the College of the City of New York took place on the 5th of November at the Manhattan Athletic Club Ground, Eighty-Sixth street and Eighth avenue. A one-hundred-yard handicap was won by E. B. La Fetra, class '86—time, $10\frac{3}{4}$ seconds. A half-mile handicap was won by Harris Smith, class '86—time, 2m. $17\frac{1}{5}$s. A one-mile handicap walk was won by C. A. Clinton, class '86—time, 8m. 59s. A two-hundred-and-twenty-yard hurdle race was won by C. F. Bostwick, class '87—time, $33\frac{1}{2}$ seconds. A one-mile bicycle race, handicap, was won by W. R. Ferris. In a spirited one-mile handicap run T. W. Martin, class '85, came in first—time, 5m. $15\frac{4}{5}$s. The quarter-mile handicap was won by A. J. Murberg, class '87—time, 63 seconds. In the running, broad jump, handicap, C. L. Woolley, class '88, came off victorious by 17 feet 4 inches. The baseball throwing competition was won by D. M. Marvin, class '84, his best effort being 281 feet $8\frac{1}{2}$ inches.

— Prof. C. V. Riley, the entomologist of the Department of Agriculture, has deposited with the Smithsonian Institute his own private collection of insects, with the idea of using it as a nucleus for the development of a collection fitting the dignity of a national museum. The collection deposited comprises some 30,000 species and upward of 150,000 specimens of all orders. The most important addition to the Institute has been Mr. Ridgway's private collection of American birds, containing 2,302 specimens of 778 species, especially important because the specimens have been selected in the field to illustrate variations of color and form due to age, sex and geographical location.

— President Barnard, of Columbia College, in a letter gave the result of careful computations which he had made relative to the disintegration of the Central Park obelisk's surface due to exposure to the weather. His opinion is that it will take 6,000 years of exposure in this climate to reduce the volume of the obelisk to the depth of 1 cm. on each side. "The waste in a century would be, therefore, scarcely a perceptible amount," he concludes.

— Children are very wise. While the philosopher and his family were quizzing each other as to what ought to be done in case of fire, little Jack said, "Father, what would you run for if the house were all ablaze?" The old gentleman declared that he should run for a very valuable manuscript. "I wouldn't," responded the boy; "I should run for the door."

— A party of Italian scientists have just returned from an expedition to the South Pacific, having proved to their own satisfaction that a race of giants once existed in Patagonia. In wandering over Terra del Fuego, they found human bones of marvellously large size.

Our Book Table.

Plaster and Plastering; Mortars and Cements. How to Make and How to Use. Being a Complete Guide for the Plasterer in the Preparation and Application of all kinds of Plaster, Stucco, Portland Cement, Hydraulic Cements, Lime of Tiel, Rosendale and Other Cements, with Useful and Practical Information on the Chemistry, Qualities and Uses of the various kinds of Limes and Cements. Together with Rules for Measuring, Computing and Valuing Plaster and Stucco Work. To which is appended an Illustrated Glossary of Terms used in Plastering, etc. Besides numerous Engravings in the Text, there are Three Plates, giving some forty figures of Ceilings, Centrepieces, Cornices, Panels and Soffits. By Fred. T. Hodgson. Industrial Publication Co., New York. Price (Cloth), $1.00.

For amateurs who have occasion to make plaster casts of any kind, or who may have to use mortar or cements of any kind, this book will be found valuable, as it contains rules and directions for using plaster-of-Paris, cements and mortars for many purposes that the enterprising amateur will sometimes require. Indeed, every man who builds, or has a house built for himself, would find this work a great help to him in understanding and appreciating the value and character of the plastering and stucco work he may have done. To the operative plasterer the work will prove invaluable.

HOLIDAY GIFT BOOKS.

The holidays are at hand, the days on which congratulations are given and received, and on which are made those little gifts that do so much towards tightening the bonds of affection and love that should always exist between friends and relatives. Among these gifts, books always take a prominent place, and we therefore take this opportunity to give such information on this point as we may collect, so that intending purchasers may be able to choose their books with some idea of what they are to get. We take pleasure, therefore, in submitting the following notices of Holiday Gift Books, with prices, when convenient, titles, and such other remarks as we may deem necessary for the interests of our readers. Indeed, we positively will not name a book in these columns that contains between its covers anything that might be considered objectionable.

The Recollections of a Drummer Boy. By Henry M. Kieffer, late of the One Hundred and Fiftieth Regiment, Pennsylvania Volunteers. Illustrated. Jas. R. Osgood & Co., Boston.

Here is a book that will please the boys if anything full of startling adventure, camp life, and funny escapades will. The book is full of interesting events and lively experiences. Relating to a period when the tocsin of war resounded from one end of the land to the other, a fact which gave the author, who took part in the events of those days, an opportunity of tieing together an authentic account of a number of actual events that must prove instructive to young readers, as well as interesting. The author's style is pleasant and easy, and the tone of the work throughout is commendable and elevating.

Three Vassar Girls in England. By Lizzie M. Champney, author of "Three Vassar Girls Abroad." Estes & Lauriet, Boston, Mass. Price $1.50.

It is pleasant to meet again these Three Vassar Girls with whom we once before enjoyed such charming journeyings on the continent; and who, in the present volume, take us through some of the loveliest spots in the mother country. The story itself is pleasantly given, but serves merely as a connecting link for the series of sketches of notable places, buildings, etc., many of them well known in history and fiction.

The yachting cruise in the *Coal Scuttle* gives us many pretty glimpses of the English coast with some of its legendary belongings. In the rambles taken through old towns and over country roads, one can almost see the old homesteads, ruined castles, and stately halls, and smell the violets and sweet brier hedge-rows.

The book is brought out in most attractive form. The illustrations with which it is profusely enriched are by such distinguished artists as Champ, and others equally well known. Many of the plates are full-page in size, and show us many renowned places, adding much to the value of the book. Both for the story itself and the pretty setting given it, the book is worthy a prominent place among the holiday volumes for the coming season.—C. A. H.

The English Bodley Family. By Horace E. Scudder. Houghton, Mifflin & Co., Riverside Press, Cambridge, Mass.

An excellent Holiday Book, being the history of a tramp through England by a group of merry young people, who exchange their opinions regarding historical places, personages, and events. When we say that several of the young people who are introduced to the reader are Americans, the fact will doubtless make our young readers more anxious to procure a copy.

The work is handsomely illustrated with fine wood-cuts of historical places and events, which add very much to its value and instructive quality. The pleasing style and general cheeriness of the work, make it easy and attractive reading.

The American Girl's Home-Book of Work and Play. By Helen Campbell. C. P. Putnam's Sons, New York.

Here is a book that will be hailed with pleasure by the girls, as it is designed exclusively for their use, and for their amusement and instruction. Do

they want to make ornamental work of paper, instructions are to be found here. Do they wish to make all kinds of paper toys, play games, act charades, celebrate Hallow-een, or make fun and amusement for the smaller children, by the aid of this book it may all readily be done.

Part the second gives rules and instructions for out-door games, such as Lawn Tennis, Archery, Croquet, Lawn Billiards, Swimming, Boating, and many other things a girl would like to know. Part the third explains about fancy work of various kinds. How to make Christmas Gifts from Paper, Leather, Bark and many other things. Wax-Flower Making, Wood Carving, Flower and Fruit Culture, Drawing, Designing and Cooking all come in for a fair consideration, and the whole is written in an easy and clear style, and is illustrated with a large number of descriptive cuts, which tend to make the text easily understood. Every house in which there is a girl should contain a copy of this book, for it contains a rich mine of innocent amusement and useful information.

Zigzag Journeys in Northern Lands; from the Rhine to the Arctic. By Hezekiah Butterworth. Estes & Lauriet, Publishers, Boston, Mass. Price (Cloth), $2.25.

This is an excellent book for young people, being amusing, instructive, and interesting. The subject is a history of a summer trip through Holland, Belgium, Germany, Denmark, Norway and Sweden, with historical sketches and anecdotes of the localities visited, and authentic picturesque views of many of the ruins, buildings, and places along the line of travel.

The style is easy and graceful, and the entertaining stories and romantic incidents that are interspersed throughout the whole work, make the book pleasant reading. Indeed, there are few holiday books now obtainable that contain better and healthier reading than the one before us.

Dooryard Folks and a Winter Garden. By Amanda B Harris. Illustrated. Boston: D. Lothrop & Co.

It will not be difficult for our readers to guess who are the "Dooryard Folks" that are described in this charming book. The author tells us all about the animals that frequent our gardens and near woods; about the mole, the mink, the weasel, the fox, the squirrel, the chip munk, and others. And the stories are told in a most delightful way. No young person who has any taste for nature can fail to be interested in the stories, and the author observes so closely, and tells her tale so truthfully, that her work deserves to take, on the shelves of our children's libraries, the place which White's "Natural History of Selborne" occupies on the book shelves of older persons. Parents who wish their children to become familiar with nature can find no better aid than this book.

The number of curious animals of comparatively large size that can be found, even in the vicinity of our large cities, is something surprising to those who have not been close observers. About our own dooryard, which is within twenty miles of New York City, and within less than half an hour's walk of a city of over 50,000 inhabitants, we find the fox, the rabbit, the weasel, the raccoon, the grey and the flying squirrel, besides several other four-footed animals, while amongst birds we find the whip-poor-will, the grouse, the heron, the quail, besides robins, blue-birds, jays, cat-birds, snow-birds, cedar-birds, blackbirds, high-holes, meadow larks, wild pigeons, ring doves, etc., etc. Leaving out the insects, the fauna of any hillside would form a wonderful collection if brought together.

Magna Charta Stories. Edited by Arthur Gilman, A.M. With Full Page Illustrations. Boston: D. Lothrop & Co.

We have here a series of twelve stories by different authors, who each in turn takes up the tale of some noble fight for liberty, and puts it in a shape to interest. No "Indian stories" can be more attractive; no tales of adventure more thrilling; and we sincerely hope that it will take the place of the trashy blood-and-thunder tales which are now so eagerly devoured by many boys.

A Year of Sunshine. By Kate Sanborn. James R. Osgood & Company, Publishers, Boston, Mass.

This is a spicy little book, and consists of numbers of cheerful extracts for every day of the year, selected and arranged by the author. The work has reached its second edition, and bids fair to become a permanent companion to many now in their childhood.

Miss Sanborn has succeeded in stringing together, in this book, many of the most pleasing gems in English literature, and the publishers have supplemented her efforts by presenting them to the public in a style of printing and binding that reflects credit on their judgment, good taste and liberality. Doubtless, thousands of these books will be given to lady friends by intelligent young men during the coming holidays.

Chatterbox for 1883 as usual leads the way for the crowd of books for the coming holidays. The book is full of cheery little stories, admirably adapted for the little ones of both sexes, and besides the stories it contains something like 200 full-page illustrations, all of which are finely engraved. We take pleasure in recommending this book as one worthy of being placed where young children may read it. (Boards, 4to., pp. 412.

Price $1.00. Estes & Lauriet, Publishers, Boston, Mass.)

Cassell, Petter, Galpin & Co., of London, Paris and New York, have just issued their very pleasing gift books for children of small and of large growth. One of them is entitled "Little Folks," and it is really a magazine for the young, consisting of a new and enlarged series. Another is "Sunlight and Shadow," and consists of poems and pictures of light and nature. It is worth remarking, however, that very few poets of note figure in these pages. The third volume is entitled "Jingles and Joys for Wee Girls and Boys," by Mary D. Brine. It fulfils its mission in a very desirable manner and is doomed to popularity.

Astronomy for Amateurs.—December.

BY BERLIN H. WRIGHT.

(All Computations are made for the Latitude and Meridian of New York City.)

THE PLANETS.—DECEMBER, 1883.

Mercury will not be visible in December.

Venus will be five degrees south of the Moon on the first, and about seven on the 31st. She is moving eastward past the stars of the constellation Sagittarius. At the beginning of the month she will be just above the bowl of the Milk-maid's Dipper, and at the close just below the only conspicuous stars in Capricornus—the three of the 3d magnitude in the head of the Goat. She sets as follows:

December 10th—5 49 evening.
" 20th—6 9 "
" 30th—6 33 "

Mars' position has changed but little since last month, being still near the Sickle in Leo, and rising as follows:

December 10th—9 17 evening.
" 20th—8 41 "
" 30th—7 59 "

Jupiter is keeping company with Mars, being about one hour or 15 degrees west of him, and rising as follows:

December 10th—7 54 evening.
" 20th—7 11 "
" 30th—6 26 "

He will be 5 degrees north of the Moon on the 16th. The eclipses of his satellites visible this month are:

Sat.	D.	H. M.		
I.	5	3 26	morn.	Beg.
I.	6	9 54	eve.	"
II.	8	9 12	"	"
IV.	11	10 43	eve.	Beg.
IV.	12	2 37	morn.	end.
I.	13	11 47	eve.	Beg.
II.	15	11 48	"	"
I.	21	1 41	morn.	"
I.	22	8 9	eve.	"
II.	23	2 25	morn.	"
I.	28	3 34	"	"
IV.	28	8 53	eve.	end.

During December the shadow of Jupiter is directed slightly to the right, and as the satellite passes from right to left, all of the above beginnings or disappearances must occur to the right or west of the planet, and as Satellite IV. is so much further removed than the others, his reappearance will be visible, but very close to the western limb of the planet.

Saturn will be in close conjunction with the Moon on the 12th, being but one half of one degree north of that luminary He passes the meridian as follows:

December 10th—10 58 evening.
" 20th—10 16 "
" 30th— 9 34 "

METEORS OR SHOOTING STARS.

The month of December is not remarkable for meteoric displays, however several quite active groups are encountered.

The Andromedes and Geminides mentioned last month, continue into December; the first until the 7th, and the last until the 27th. The Taurids II., radiating from near the great Crab Nebula, 3° S. of Beta Tauri (Aurigæ), Dec. 6th—12th. The Polarids I., from very near the Pole star after the 20th, and a few from near the middle star in the handle of the Great Dipper, in Ursa Major, are the principal ones visible in December.

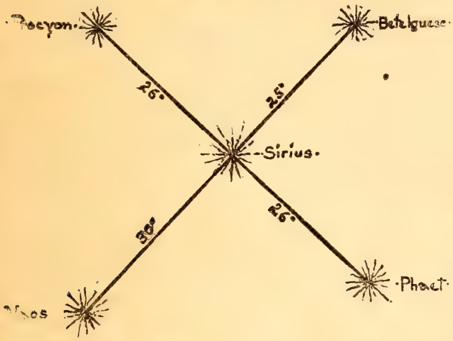
SITUATION OF THE PRINCIPAL STARS, CLUSTERS, AND CONSTELLATIONS IN DECEMBER, AT 9 P.M.

The most beautiful and interesting portion of the firmament, is presented to our view in the evenings of December, January and February. In December the portion lying east of the meridian, possesses the greatest array of glorious objects.

Mira, the wonderful variable, is near the meridian and just below the equator of the heavens. This star has a period of 331d. 8h. 16m. (Peters), and will not be at maximum again until next spring, being now on the decline and almost invisible. It changes from a 3d. magnitude star, to invisibility. A south-east diagonal through the square of Pegasus, produced one and one-half times as far, reaches it. To the left 15°, is the 2d. magnitude star, Menkar, in the head of the Whale, and the only bright star in that large constellation. The Ram, with one bright star in a cluster of dim ones, lies 20° N., and the head of Medusa, of which cluster the variable Algol is one, is in the zenith.

To the left, or east of the meridian, the zodiacal constellations are, in their order from W. to E.: Tauris, Gemini, Cancer and Leo. In the first, are the Pleiades, Hyades and Saturn; in Gemini, the bright stars Castor and Pollux

and a host of other interesting objects; in the next, Jupiter and Præsepe; and in Leo, Mars Regulus and the Sickle. South of the zodiac is a still more brilliant field. Low down in the south the two brilliants, Phaet in the Dove, on the right, and Naos in the Ship on the left, 30° apart, form the southern termini of the legs of the Great Egyptian **X**, having the great Sun, Sirius as its centre, and Procyon in the Lesser Dog, and Betelguese in Orion as the northern termini thus:



To the right of Sirius is the Hare, indicated by a neat four-sided figure, and above it is Rigel. The Trapezium and the Kings or "Stars of Orion's Belt," and Leo and the Sickle, are rising.

To the west or right of the meridian Andromeda, just N.E. of the Great Square of Pegasus, and the **λ** in Aquarius. S.W. of it are the most conspicuous objects. Away in the N. W. we see the Great Cross, with Deneb at its head, and lying in the Milky Way; and the Harp and Vega, two most beautiful objects.

In the circumpolar regions, the Great Dipper, in Ursa Major, is low down and a little to the East. The Little Dipper, Draco and Cassiopeia, are to the left or west of the pole, and the Segment of Perseus, Auriga and Capella, are to the right.

EPHEMERIDES OF THE PRINCIPAL STARS AND CLUSTERS, DECEMBER 21ST, 1883.

		H. M.	
Alpha Andromeda (Alpheratz)	in merid.	6 2	eve.
Omicron Ceti (Mira) variable,	"	8 13	"
Beta Persei (Algol) "	"	9 0	"
Eta Tauri ("Seven Stars" or Pleiades)	"	9 40	"
Alpha Tauri (Aldebaran)	"	10 28	"
Alpha Aurigæ (Capella)	"	11 7	"
Beta Orionis (Rigel)	"	11 8	"
Alpha Orionis (Betelguese)	"	11 48	"
Alpha Canis Majoris (Sirius or "Dog Star") rises		7 39	"
Alpha Canis Minoris (Procyon) rises		7 14	"
Alpha Leonis (Regulus)	"	9 17	eve.
Alpha Virginis (Spica)	"	1 58	mor.
Alpha Bootis (Arcturus)	"	1 1	"
Alpha Scorpionis (Antares) invisible			
Alpha Lyræ (Vega) sets		9 26	eve.
Alpha Aquillæ (Altair) sets		8 14	"
Alpha Cygni (Deneb) "		0 36	mor.
Alpha Pisces Australis (Fomalhaut) sets		8 50	eve.

De Land, Florida.

Novelties for Amateurs.

A number of excellent devices were on exhibition at the American Institute Fair this year, suitable for amateurs and amateur work. Among which we may mention. (1) The Economic Motor, manufactured by the Economic Motor Co., 28 Beekman Street, New York. This is a first class motor for amateurs using lathes, scroll saws, or other machines requiring power from one-half man to four men, and as the cost is only from $75 to $175, the motors may be considered cheap. The power is derived from the rapid ignition in the cylinder of a combustible mixture of illuminating or heating gas and air, which enters the cylinder through automatic valves. When the amount necessary to propel the piston has been drawn in, ignition takes place, and the piston is forced upward to the top of the cylinder, imparting a rotary motion to the crank-shaft and fly-wheel. The momentum of the latter completes the revolution, driving out the product of combustion through an exhaust valve, when the gas and air enter again and the operation is repeated.

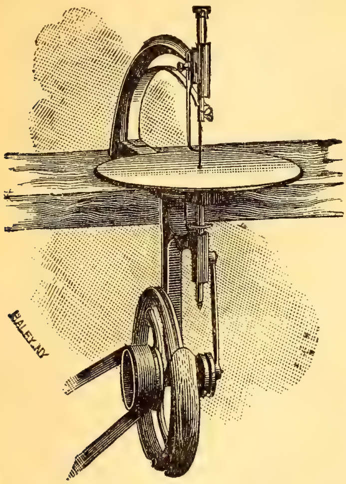
(2) Another useful machine for amateurs—or professionals, for that matter—is the adjustable mitre-planing machine, exhibited by Theodor Schreppel & Co., of 101 Bowery, New York.

This is simply a mitering machine worked with a lever and rack, and is a decided improvement over the old style mitering machines. The facility with which it is worked does away with the necessity of having the attendance of two men to turn out good work, the employment of the lever and rack enabling even a boy to use both cutters without changing his position or using extraordinary exertions, and therefore twice as much work can be easily performed by a boy or unskilled mechanic with this machine than could have been performed by two skilled men with the old fashioned machines. The machine being entirely constructed of metal, the changes of the temperature and atmosphere have no effect upon the same.

(3) Of scroll saws there were quite a number, among which may be mentioned the Challenge and Rival, manufactured by the Seneca Manufacturing Co., and Barnes & Co., of Rockford, Ill.

The Seneca Manufacturing Co. have also in

the market, a new saw, No. 4, which is so arranged that it may be attached to table or workbench. It is simply a new and cheap arrangement of the Challenge Scroll Saw for power, and is easily fastened with screws or bolts to a work bench or any place desired; takes but little room, and is a very



desirable machine for manufacturing purposes, etc. It is driven by a one inch flat belt; has the same capacity for cutting, etc., as the Challenge machine, but has no drilling attachment. The Challenge lathe attachment can be used on this machine.

Besides machines, there were a number of other articles exhibited that many of our readers would no doubt like to know something of.

One of the most artistic, and, as it appeared to us, a useful and instructive article, was a table lamp, exhibited by C. F. A. Hinrichs, of Nos. 29–33 Park Place, New York. The lamp, handsome in itself, and artistically decorated, possessed its greatest value, from our point of view, from the fact that the shade of semi-transparent glass was nearly spherical in shape, and represented a globe of about eight inches in diameter, having on its face the continents, islands, seas, and oceans, shown in colors the same as an ordinary school globe. It will readily be seen how useful this lamp would be where there are children studying geography, after school, during winter evenings. We need not add, that older folks would find this arrangement useful and pleasing when reading in their evening papers of the doings and misdoings of the denizens of distant lands. One of these globe shades should be in every house.

Palm & Fechteler, No. 6 West Fourteenth street, New York, had on exhibition a beautiful assortment of silk and decalcomania ornaments suitable for decorating odor bottles, tidies, cushions, lamp shades, sachets, etc.; in fact, any article made of silk, linen or cotton. The various designs of silk ornaments form very attractive decorations in themselves. However, more handsome and extremely elaborate ornamentations can be made by tastefully combining a variety of the designs, or parts thereof, to almost any desired shape. This method gives considerable scope for a large variety of ingenious designs that may be created by the personal talent and inventive abilities of the amateur.

The Murray Hill Publishing Co., of 129 East Twenty-eighth street, New York, exhibited a novelty called the "Polyopticon," which consists simply of a lamp shade made of heavy binder's board, neatly covered with leatherette, and has metal parts as required, including two reflectors. It is made so as to be easily adjusted to all round-wick or argand lamps (those using straight or students-lamp chimneys), and as these are the best lights for reading, they are to be had almost everywhere. It rests on argand (round wick) burners in such a way as to permit the regulating of the light below. With a good light it is possible to show a picture on a screen six feet distant, and a circle of light four feet in diameter. This makes a common photograph appear four hundred times its real size, or about fifteen times "as large as life." By shortening the distance of the Polyopticon from the screen, the picture becomes brighter and smaller, and can be reduced to "life size," or any size that is desired for sketching a portrait. Thus it is of use to artists. Anyone handy with a pencil can make funny sketches, faces with movable eyes or tongue, or a donkey that can move his ears, and produce effects equal to those made by special "slides" that cost two or three dollars a piece. It is certainly fair to say that all magic lanterns costing under $25 are outdone by the Polyopticon, and that the latter is just the thing for every home that wants a private show for its own amusement. In no other way can so much fun be had for the same amount of money. The instrument complete with a number of views costs less than six dollars. This instrument is capable of affording an immense amount of amusement for the "family circle," or even a gathering of friends.

Scientific News.

—The oldest tree in the world, so far as any one knows, is, says *Knowledge*, the Bo tree of the sacred city of Amarapoora, in Burmah. It was planted 288 B.C., and is therefore now 2,170 years old. Sir James Emerson Tennent gives reasons for believing that the tree is really of this wonderful age, and refers to historic documents in which it is mentioned at different dates, as 182

A.D., 223 A.D., and so on to the present day. "To it," says Sir James, "kings have even dedicated their dominions, in testimony of a belief that it is a branch of the identical fig tree under which Buddha reclined at Urumelaya when he underwent his apotheosis." Its leaves are carried away as streamers by pilgrims, but it is too sacred to touch with a knife, and therefore they are only gathered when they fall. The King Oak in Windsor Forest, England, is 1,000 years old.

—The just now popular word dude, meaning an empty-headed, languid-mannered young swell who bangs his hair, proves to be no foreign importation, but, like many another expressive term, to be of good New England parentage. The word (pronounced in two syllables) has been used in the little town of Salem, N. H., for twenty years past, and it is claimed, was coined there. It is common there to speak of a dapper young man as a "dude of a fellow," of a small animal as "a little dude," of a sweetheart as "my dude" and of an æsthetic youth of the Wilde type as a dude. But how the word attained so sudden and widespread a notoriety puzzles Salem. Its revival at New York is credited to a distinguished Englishman, who remarked, after visiting a rich club, that the young men were all "dudes."

—In a recent lecture on solar physics at the Royal Institution, Sir Wm. Siemens gave his reasons for setting the temperature of the photosphere of the sun at about 2,800 degrees C., instead of about 10,000 degrees, where Rosetti and other late investigators put it. He agrees, in this lower estimate, with Violle, St. Clair, Deville, and Sir William Thompson, and thinks the solar temperature can not much, if at all, exceed that of the most powerful electric arcs. He recognizes fully the fact that a temperature higher than 3,000 degrees C. would be absolutely conclusive against his theory that the solar heat is due to the recombination or burning of compound gases at the surface of the sun. He bases his estimate of the solar temperature upon three foundations: First, the behavior of a carbon rod and a small gas flame in the focus of a reflector exposed to the sun; second, on a comparison between the spectra of various lights—for instance, the Argand burner, an incandescent lamp, the electric arc, and the sun itself, as observed by Langley on Mount Whitney; third, upon experiments on the relation between radiating power, made by means of a long platinum wire heated by an electric current.

Practical Hints.

—In New York City, a short time ago, a man died from poison, communicated while handling some buffalo hides sent from India. His companion worker employed on the same job was taken sick, and after a severe illness finally recovered. Both the men became warm, perspired freely, and repeatedly wiped the sweat from their faces with the bare hand, each of the men having a pimple on the face. Whether the death of the one and the illness of the other was caused by the virus from the hide of a diseased animal, or by the absorption of arsenic used in the preservation of the hides, is not positively known. Probably, however, the cause was disease communicated from an infected animal through its hide, as the Calcutta packers use, frequently, an arsenical preparation on the hides to kill a small brown worm that otherwise might destroy the hides, and instances of poisoning in handling these hides are not uncommon. Some years ago an importer of hides in New York died irom the effects of a bite or sting of a fly which inhabited the loft where the hides were stored.

—Christian Knab, in Munchberg, Bavaria, makes a blue preparation good for marking trunks and boxes, because it readily combines with wood, cloth, etc., and resists the action of the weather. His process is given in the *Deutsche Industrie Zeitung* as follows: 100 pounds of a 30 per cent. fluid extract of logwood are put in a suitable kettle, with 3 quarts of alcohol, to which 2 pounds of hydrochloric acid has already been added.

The mixture is kept at 68° Fahr., and well stirrred until thoroughly mixed. Next he dissolves 10 pounds of (yellow) chromate of potassium in 30 pounds of boiling water, and adds to it 20 pounds of hydrochloric acid, stirring well, and when it has cooled to 86° Fahr., stirs it very slowly into the mixture already in the kettle. The whole is then warmed to about 185° Fahr. The mass, which then becomes an extract, is stirred a short time longer, and to it is added 30 pounds of dextrine mixed with 20 pounds of fine white earth (terra alba), and well stirred through. The mass, when taken from the kettle, is put into a mill, where it is thoroughly worked together. It is, lastly, put into tin boxes and left standing a long time to dry out.

—The fine scrapings of any common cattle's horn steeped in vinegar and bound hot as can be borne upon a wound, will subdue pain almost instantly, and effectually subdue lockjaw. I have often used this remedy, and have never had a failure. In wounds torn and lacerated, as, for example, where a nail has been stepped on penetrating the sole of the foot, and the patient wild with pain, countenance livid, teeth chattering, limbs trembling and lockjaw seeming inevitable, with this remedy I have produced perfect quiet, relaxation of muscles and freedom from pain, and even from soreness of the wound, in the space of fifteen minutes time. I was called in haste to see a young man of 15 years who had stepped on a nail I found him almost in spasms, and had no remedies with me. In the house I found a powder horn, and with a piece of glass went to scraping. As soon as I had a common thimbleful I barely covered it with vinegar and heated it as hot as could be borne, and, setting others to scraping, I applied it to the wound, changed often as soon as cool, adding the scraping accumulated, and with this treatment had the boy easy and out of danger in fifteen minutes. I know not what there is in horn that produces this effect, which I have seen many times, and

have often wished there might be some preparation of this remedy a little more convenient to use than the crude material.—Dr. S.

Notes and Queries.

In continuing this department, which has been found of so much value, we would remind our readers who wish for information on any of the arts and sciences, that they are cordially invited to make their wants known through this column, and those of them who can furnish accurate answers to questions asked are requested to send in replies. Doubtless many of our subscribers may know of methods, processes, or devices that may be better or more suitable for the particular case in question than anything generally known, and it is this reason that induces us to keep this department open for a medium, where an interchange of ideas and practices may be made to the advantage of all our readers. Correspondents will please send their full address when forwarding their communications—either questions of answers—not for publication, unless expressly so stated, but so that we may know where to find the writer if desirable. Communications should be sent in on or before the first or each month previous to publication, to insure insertion in next issue.

Answers.

152. Amateur.—In general nothing more is necessary, after ascertaining your joint is perfectly straight, and as is technically called, out of winding, than to glue both edges, with the glue quite hot, and rub them lengthways till the glue is nearly set, but not chilled; however, when your wood is spongy, or sucks up the glue, the following method will be advisable, as it strengthens the joint, and does away with the necessity of using the glue too thick, which should always be avoided, as the less glue there is between the joint, provided they touch one another, the better, and when the glue is thick, it sooner chills, and we cannot well rub it out from between the joints; the method is to rub with a piece of soft chalk each joint on the edge, and wipe it off again with your finger, so that no lumps remain, and then glue it in the common way; it will be found to hold much faster, particularly when the wood is porous, than when glued without the chalk.—Chip.

153. Episcopalian.—The following explanations are, perhaps, all you will require:

EMBLEMS OF GOD AND THE FATHER.

1. "The Hand Issuing from the Clouds"—Represented either entirely open, in the act of bestowing, or with fingers arranged according to the Greek or Roman gesture of benediction.
2. "The Face, or Bust, in the Clouds"—Not used in modern times.
3. "The Triangle"—Represented with the name of the Father, in Hebrew, in the centre, and surrounded by rays, the triangle symbolizing the Trinity, and the whole sometimes contained in the circle, the emblem of eternity.
4. "The Flood of Light"—(Esek. viii. 2.)

EMBLEMS OF GOD THE SON.

5. "The Fish"—The Greek word for fish (*icthus*) is composed of the initial letters of the Greek words which mean "Jesus Christ, Son of God. Saviour." The fish is one of the most ancient and most common Christian emblems, and has many significations, for which see below.
6. "The Cross"—Christ's suffering; the humanity of Christ.
7. "The Lamb"—This was the type of the Saviour in the Old Testament. See also John i. 28. Bearing a cross, or banner, called the Lamb of God. Represented with a nimbus or aureole.
8. "The Lion"—"The Lion of Judah."
9. "The Vine."

EMBLEMS OF THE HOLY SPIRIT.

10. "The Dove"—The usual representation.
11. "A Man, or a Child"—(Mediæval)—often shown accompanied by a dove.

EMBLEMS OF THE TRINITY.

12. "Three Triangles"
13. "Three Circles"—Circles and triangles were often intermingled.
14. "Three Human Beings," accompanied respectively by the appropriate symbols of the three persons of the Trinity.
15. "Three Fishes."
16. "Two Human Figures," with a Dove between them.
17. "The Father" holding by the cross-beam, a cross with the figure of Christ upon it, and a dove proceeding downwards from the lips of the Father.
18. "The Trefoil or Clover-leaf."—Clericus.

154. Kino.—Guinea-pigs must be kept very cleanly, else their places are apt to smell disagreeably. They are fond of changes of diet. Give oats or grain of some kind once a day, and bread soaked in milk; also an allowance of garden roots, cabbage, greens of any kind, or weeds, such as sowthistle, plaintain, etc. They ought to have water to drink.—Keeper.

155. F. K.—A first-class violin has seventy separate parts. Two form the back, two the belly, six the blocks, six the sides, twelve the lining, twenty-four the purfling, and there is the tail-pin, its peg and fastening, the tail-piece, the bass-bar and sound-post, the bridge, nut, head and scroll, the finger-board, and the four pegs and four strings. The body weighs about half a pound, with the neck and scroll about twenty ounces, and when tuned to pitch the pressure on the bridge is over ninety pounds.—Fiddler.

156. Katie B.—Skins of all kinds can be dressed for making trimmings or muffs simply enough as follows: First, as to cleaning. Stretch the skin, feather, or fur downwards on a board, and tack it there; then with a knife remove every bit of flesh and fat, and scrape it well; then rub over with alum and soda pounded together in a little water; leave it to dry for a day or two, then scrape again and rub down with pumicestone to soften. A final dressing of alum alone will suffice to preserve it, and softening can only be performed by the application of elbow-grease.

Try to obtain fresh skins, if the fur pulls out they are useless. Cut open the skin so as to get at all the fleshy parts, then get some soap-suds or rain water, and well soap them (care being taken in not having water too hot), let them lie for six hours in the water, then well rinse them in clean water, take off all fat and flesh that may adhere to the skin. Then get some bran, and put some in the bottom of a pan, or tub, putting a layer of bran between each skin, then put cold water, till by pressing the bran on top of the skins you can see the water come through, let them stay for two days. Prepare a mixture of 3 parts ground alum and 1 part salt into a paste by adding cold water, and well rub into every part of the skin on the fleshy side, then make a wooden frame, and stretch the skin on it; let it lie, hair downwards, for twelve hours, then go over with the mixture again. Hang up to dry, if possible, where the sun can shine on them. Before they get quite dry, get a piece of pumice-stone and well rub the inside of the skin, and you will find that all the fleshy part will peel off, and leave the skin white, and if the pumice-stone is persevered with, will be perfectly pliable. If the skin should be an extra hard one, go over with the mixture again, adding a little more water, and finish again with pumice-stone. I have nearly a hundred skins made into rugs, which have been in use six years, and they are as good as ever they were. This is my own way of curing them perhaps some one of the readers of the Young Scientist may know of some quicker way. I cannot enlighten you in any other way to make them soft, the principal thing

in regard to that, is the stretching on the wooden frame.—SADIE.

157. ANXIOUS.—When a canvas is broken, rent, or perforated in any part, the piece of canvas that is used to repair the damage is dipped into melted wax, and applied the moment it is taken out, warm as it is, to the part, which has been previously brought together as well as possible, and also saturated with the wax. With great care you flatten down the piece; so that as the wax chills and concretes, the parts adhere and are kept smooth. The whole being made perfectly level, and the excess of the wax removed, a mastic made of white lead mixed with starch is applied; for oil-color does not adhere well to wax. The white is afterwards colored thin, or by washes, according to the tone of the surrounding parts, and repainted.—NEPTUNE.

158. WILLING TO LEARN.—Here are a number of recipes for ebonizing, all of which are said to be good:

1. Infuse gall-nut in vinegar into which rusty nails have been soaked; paint the wood with this, and polish and burnish when dry. 2. Wash the wood repeatedly with a solution of sulphate of iron, made by dissolving 2 oz. of sulphate in a pint of hot water. When dry, apply a hot decoction of logwood and nut-gall two or three times. When dry, clean with a wet sponge and then polish. 3. Brush the wood with a strong decoction of logwood chips several times. When dry, give it a coat of vinegar in which rusty iron has been placed. Dissolve beeswax in turpentine by setting in a warm place; apply warm with a brush, and rub it till it shines. 4. Wash with a concentrated aqueous solution of logwood several times, and then with a solution of acetate of iron of 40 deg. Baume. Repeat till a deep black is produced. 5. Put 2 oz. of logwood chips with 1¼ oz. of copperas in a quart of water, boil, and lay on hot. When dry, wet the surface again, with 2 oz. of steel filings dissolved in half a pint of vinegar. When dry again, sand-paper smooth, then oil, then fill in with powdered dropblack mixed in the filter. Work to be ebonized should be smooth and free from holes. Give it a light coat of quick drying varnish, then rub with finely pulverized pumice-stone and linseed oil until very smooth. 6. Boil ½ pound of chip logwood in two quarts of water, and add ½ oz. of verdigris, and ½ oz. of copperas, strain, and put in ½ pound of rusty steel filings. With this go over the work a second time. 7. A pound of logwood boiled in four quarts of water, add two handfuls of walnut shells or peel, boil up again, take out the chips, add a pint of vinegar, and apply boiling. Afterwards dissolve 1 oz. of green copperas in a quart of boiling water and apply hot. 8. First sponge the wood with a solution of chlorhydrate of aniline in water, to which a small quantity of copper chloride is added. When dry, go over again with a solution of potassium bi-chromate. Repeat this twice or thrice. 9. One gallon of vinegar, ½ pound of green copperas, ¼ pound of China blue, 2 oz. nut-gall, 2 pounds extract of logwood. Boil all these over a slow fire, and add half a pint of iron-rust. Apply as usual. A good varnish for ebonized work is made by dissolving in alcohol some black wax.—X.

159. SADIE.—In answer to Sadie, for instructions how to take impressions of ferns, etc., I will describe the method I adopt, which is—Procure some smooth cartridge paper, then take the ferns or leaves and arrange them in position. If ferns, they look well put in groups; if ivy, it will look well as a border, but whichever it is, put a pin through a leaf here and there, to keep the fronds from moving—very fine pins, or the holes will show. Then procure a small tooth-comb, a stick of Indian ink, and a tooth-brush. Dissolve the ink in water—don't get it in lumps—and dip your brush in the ink—do not get too much on—and rub in gently along the comb, holding it over the group of ferns. If you get too much ink on your brush, it will fall in big drops; the object is to make them as fine as possible. Rub more on near the joints of the ferns, just as in a photograph, and let the color gradually die away to the edge. Take the ferns off, and you will be surprised at the effect you have produced. If done neatly your ferns will bear a strong resemblance to a large-sized photograph. I shall be happy to supply further instructions if these are not sufficient.—KATIE V.

160. ETCHING.—Etching will find this a ticklish job, and great care must be used with the acids in working. He can try the following on a piece of plain glass first, and if it answers, well and good, if not let him write again and I will send another: this being a recipe I have by me, so cannot speak as to its merits. The glass to be etched should first be heated then coated with an even film of wax or paraffin, melted; soon as set, proceed to etch the design or pattern through it with a fine point or graver. Next obtain or make yourself a shallow lead tray and put in it some floride of calcium (fluor spar), in fine powder, mix to a thin paste with some strong oil of vitriol, and place tray on a warm sand bath, which is a box of sand made hot in the oven, when hot enough it will keep hot for some time after; now place the glass tightly over the tray so that the corroding gas comes in contact with the surface exposed by the lines etched. In ten minutes the design will be etched the lines being translucent. If desired to make the etching opaque (white), the plate should be wet before exposing it, a little benzole will remove the superfluous wax or paraffin from the glass.—DIAMOND.

Queries.

1. TURNPIKES.—Can any one tell me why long country roads are sometimes called "Turnpike Roads?"—CURIOUS.

2. DISTEMPER.—Having a fine mastiff dog that appears to be suffering with distemper, I should be pleased if some fellow reader would give me some instruction how I should treat him.—KANSAS.

3. PAINTING PHOTOGRAPHS.—What is used as a medium for painting photographs? Any information will be appreciated by YOUNG CAMERA.

4. VARNISHING PAPERS, PICTURES, OR MAPS.—I have a few colored pictures and maps I should like varnished, and would like to know how the paper should be prepared for receiving the varnish. If some brother amateur who knows all about it, will kindly publish the required information in these columns.—KANSAS CITY.

5. BARBER'S POLES.—Can anyone tell me why barbers always have their signs, or poles, painted in stripes? It seems such a curious practice, that I would like to know its origin if it is traceable.—SIMPLICITY.

6. DAGUERREOTYPES.—Is it known when likenesses were first taken in this country, by aid of a camera?—KANSAS.

7. BRONZE GILDING.—I have tried to gild in bronze on several occasions, but, somehow or another, I never can get the work done sufficiently good enough to satisfy my ideas of good work. If any reader of the YOUNG SCIENTIST should know anything of the process, he or she will have my thanks, by publishing it in the YOUNG SCIENTIST.—AMATEUR.

8. MAHOGANY STAIN.—Will some one publish a recipe for staining mahogany color?—NEFF.

9. POLISHING SCROLL-WORK.—Having some scroll-work to polish or varnish, I would like a few hints on the subject, if not asking too much.—NEW SUBSCRIBER.

10 TURNING ROUND BALLS.—I want to make some round balls in the lathe, and would like to know what sort of an attachment to use for the purpose; will some "expert" amateur "rise and explain," and oblige a NOR-WESTER?

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